The Factors Affecting the Adoption of Cloud Computing in Irish Hospitals

Dissertation submitted in part fulfilment of the requirements for the degree of Master of Business Administration (MBA) Information Systems at Dublin Business School

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Master of Business Administration (MBA) Information Systems 2016
Declaration:

I, Brendan Dunne, declare that this research is my original work and that it has never been presented to any institution or university for the award of Degree or Diploma. In addition, I have referenced correctly all literature and sources used in this work and this this work is fully compliant with the Dublin Business School’s academic honesty policy.

Signed:  

Date: 22/8/16
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Trish, without you this was all impossible. If I have seen any further it is only because I have been standing on the shoulders of a giant.
Abstract

Cloud computing is one of the most high-profile trends in Information Systems today. Although capable of delivering significant benefits to organisations such as scalable computing and storage, data sharing, on-demand anytime and anywhere access, there are also risks and barriers to cloud adoption. The purpose of this exploratory, qualitative research is to identify and evaluate the factors, within the TOE (Technology-Organisation-Environment) framework of technology adoption, that affect the adoption of cloud computing in Irish hospitals. Information was gathered through semi-structured interviews of senior managers and executives with experience and expertise in information systems management and strategy and cloud computing technology in Irish hospitals. The factors that were identified as impacting adoption were: cost, data security, perceived usefulness, available resources, organisation size, regulatory & legal context and vendor support. The exploratory nature of this research helped reveal the complexities of these factors.

This research provides valuable insights to the range of stakeholders involved in and responsible for the implementation of healthcare information technology. For service vendors, this research provides a greater understanding of the requirements and concerns of hospital administrators. For the decision makers in hospitals it provides a framework of factors that should be considered during the adoption decision. For the academic community, this research contributes to a growing international discourse on the adoption of cloud computing in the hospital context and, as a useful reference, can support future study in this area.
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<td>AOB</td>
<td>Any Other Business</td>
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<tr>
<td>AWS</td>
<td>Amazon Web Services</td>
</tr>
<tr>
<td>BFS</td>
<td>Banking &amp; Finance Sector</td>
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<td>CapEx</td>
<td>Capital Expenditure</td>
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<tr>
<td>CAQDAS</td>
<td>Computer Aided Qualitative Data Analysis Software</td>
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<td>CC</td>
<td>Cloud Computing</td>
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<tr>
<td>CIO</td>
<td>Chief Information Officer</td>
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<tr>
<td>CSF</td>
<td>Critical Success Factor</td>
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<tr>
<td>DBA</td>
<td>Database Administrator</td>
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<tr>
<td>DiSoLoMo</td>
<td>Digital Social Local Mobile</td>
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<tr>
<td>DOI</td>
<td>Diffusion of Information</td>
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<td>EHR</td>
<td>Electronic Health Record</td>
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<tr>
<td>ENTP</td>
<td>Extroversion Intuition Thinking Perception</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
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<tr>
<td>GP</td>
<td>General Practitioner</td>
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<tr>
<td>HIT</td>
<td>Health Information Technology</td>
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<td>HSE</td>
<td>Health Services Executive</td>
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<td>IaaS</td>
<td>Infrastructure as a Service</td>
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<tr>
<td>ICT</td>
<td>Information and Communications Technology</td>
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<tr>
<td>IoT</td>
<td>Internet of Things</td>
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<tr>
<td>IoTaaS</td>
<td>IoT as a Service</td>
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<tr>
<td>IS</td>
<td>Information Systems</td>
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<td>IT</td>
<td>Information Technology</td>
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<tr>
<td>NIST</td>
<td>National Institute of Standards and Technology</td>
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<tr>
<td>OpEx</td>
<td>Operational Expenditure</td>
</tr>
<tr>
<td>PaaS</td>
<td>Platform as a Service</td>
</tr>
<tr>
<td>PEU</td>
<td>Perceived Ease of Use</td>
</tr>
<tr>
<td>PU</td>
<td>Perceived Usefulness</td>
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<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<td>-----------</td>
</tr>
<tr>
<td>RA</td>
<td>Relative Advantage</td>
</tr>
<tr>
<td>RoI</td>
<td>Republic of Ireland</td>
</tr>
<tr>
<td>SaaS</td>
<td>Software as a Service</td>
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<tr>
<td>SDN</td>
<td>Software Defined Networking</td>
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<tr>
<td>SME</td>
<td>Small and Medium-sized Enterprises</td>
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<tr>
<td>TAM</td>
<td>Technology Acceptance Model</td>
</tr>
<tr>
<td>TOE</td>
<td>Technology Organisation Environment</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>UTAUT</td>
<td>Unified Theory of Acceptance and Use of Technology</td>
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<tr>
<td>XaaS</td>
<td>Anything as a Service</td>
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1 Introduction

Hospitals today are faced with the twin pressures of delivering advanced IT (Information Technology) systems, capable of providing progressive patient care, while simultaneously seeking to contain costs. With the significant cost pressures continuously experienced within the healthcare sector, hospital administrators are increasingly receptive to technological innovations that can help resolve these twin pressures. Cloud computing’s potential to improve healthcare services and benefit research in a cost efficient and effective manner make it a viable solution to the technical and budgetary objectives of hospitals (Calabrese and Cannataro, 2015; Griebel et al., 2015; Lee and Meuter, 2010; Melnik, 2012).

Although some of the technologies that enable cloud computing pre-date the internet, the term cloud computing was first mentioned in newspapers in 2007, academic papers first emerged on the topic in 2008 and the first patents were filed in 2010 (Adamuthe et al., 2015). Cloud computing (CC) first appeared on the Gartner Hype Cycle, a popular measure of the maturity, adoption and expectations of early stage technology, in 2008 (see fig 2) and by 2015, having removed CC from their Hype Cycle, Gartner predicted that the focus would shift from the now mature technology itself towards how CC addresses industry and business-specific needs and opportunities (Dumont, 2015; Van Eijk, 2015).

The timely adoption of technologies and innovations is important for organisations to gain competitive advantages and achieve business objectives (Peng et al., 2014). Given the complexities involved in adopting today’s information systems, multiple and various factors in the technological, organisational and environmental contexts can impact an organisation’s ability
and motivation to implement those innovations. These factors vary across industries and investigating the subject matter in detail reveals the current concerns of decision makers, including motivations and barriers, on the adoption of CC (Nkhoma et al., 2013). The study of determinant factors of CC adoption has grown in recent years to become predominant area of CC research (Bayramusta and Nasir, 2016) and this trend is consistent with the field of HIT (Healthcare Information Technology) generally (see fig. 1)

This research aims to explore the drivers and barriers relevant to decision makers and impacting the adoption of CC in Irish hospitals. Organisations evaluating potential IS (information systems) deployments must comprehensively and systematically weigh the many risks and opportunities, and with complex and relatively new innovations such as CC, the evaluation process for hospital administrators is influenced by a complex mesh of factors acting either as barriers or drivers of adoption (Stieninger and Nedbal, 2014).
The technology and service suite that makes up CC offers many opportunities: strategically it can foster business agility and develop disruptive platforms and capabilities (Carcary et al., 2014a; Kark et al., 2015; Stamford, 2015); operationally it can enable staff mobility and collaboration, drive resource efficiencies and support business continuity (Carcary et al., 2014) and financially CC offers overall cost reductions, fixed cost reductions and lower initial capital outlays (Carcary et al., 2014a; Dutta et al., 2013; Hasty et al., 2012; Salah Hashim et al., 2015).

In today’s digital centric operating environment, IS have become integral to delivering strategic objectives across many industry sectors (Dutta et al., 2013) and decision makers must weigh the potential benefits against actual and perceived risks before committing to a cloud deployment. Many of the risks associated with CC are not unique to it but arising from its relative newness as a technology, and some high profile security and reliability failures, the risks do receive attention. Data privacy and security risks have been a significant concern for CC customers (Dutta et al., 2013) but they are not the only risks that must be weighed: internet availability and reliability concerns, contractual and legal risks, vendor failure risk, loss of IT governance and vendor lock in are just some of the risks that are of greater prevalence in CC than traditional IT solutions.

As CC matures and become more widely adopted, customers and vendors will be better equipped to assess the risks and opportunities that the technology offers. To some, CC is the most recent evolution of a technology that originated in the 1960’s with bureau computing (Calabrese and Cannataro, 2015; Dutta et al., 2013), to others it’s a megatrend (Adamuthe et al., 2015) and to many, CC represents a paradigm shift for IT infrastructure and business (Bayramusta and Nasir, 2016; Carcary et al., 2014a; Iye et al., 2013). What is broadly agreed upon is that CC offers numerous competitive advantages to organisations and that adoption of CC is increasing
significantly (Carcary et al., 2014a; Dutta et al., 2013; Melnik, 2012; Nkhoma et al., 2013). Driven by an increase in adoption arising from improving public trust and a transition to cloud first approaches, spending on CC is predicted to more than double from 2013 to 2018, rising to $127 billion (Pardo et al., 2016). Continuing cloud’s already rapid profusion, 64% of CIOs (Chief Information Officer) surveyed in 2015 expect CC to have a significant impact on their business within the next two years (Kark et al., 2015).

Fig. 2: Progress of CC on Gartner’s Hype Cycle over time (Adamuthe et al., 2015)

Globally, health care providers are recognising the need for innovation; advances in health technologies and data management are helping facilitate new diagnostic and treatment options. Advances in HIT, in particular high throughput platforms used for medical imagery, genomics and mass spectrometry, have created storage and processing bottlenecks in the analysis and diagnostic pipeline which CC is now playing an important role in solving (Calabrese and Cannataro, 2015).
1.1 Cloud Computing

CC is a disruptive technology that can be utilised as an alternative, or as an adjunct, to traditional in-house information technology (IT) services (Choudhary and Vithayathil, 2013). During the early stages of CC’s research, studies either failed to define CC or used definitions that merely described features and benefits of CC (Alshamaila et al., 2013; Griebel et al., 2015). This research will employ the widely adopted definition adopted by America’s National Institute of Standards and Technology (NIST):

“Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models.” (Mell and Grance, 2011)

The comprehensive NIST definition goes further to also define the schema of five essential characteristics, three delivery models and four typical deployment models, sometimes referred to as the CC stack (see fig 3). Considering the definition and the schema it becomes apparent that CC is not a simple technology, rather it is comprised of many interdependent complex technologies, platforms and delivery mediums which together constitute the service being offered to the customer.

Hospitals and healthcare are sectors that generate considerable amounts of sensitive patient data and must be mindful of this when assessing CC adoption. Despite such concerns, CC caters to
some key technology requirements of the healthcare industry (Calabrese and Cannataro, 2015; Griebel et al., 2015):

- Offloading large data sets for electronic health records (EHR)
- Facilitating the sharing of EHRs among practitioners and hospitals
- Improving the ability to analyse and track diagnostic information

Fig. 3: The NIST defined dimensions of CC illustrated (Dowbor, 2009)

CC has the ability to support a broad range of healthcare IS, including clinical applications (such as EHR, physician order entry, telemedicine and medical imaging) and nonclinical applications which are more typical of business organisations generally (such as revenue management,
helpdesk software, patient billing, HR and payroll management) (Calabrese and Cannataro, 2015; Grieben et al., 2015).

1.2 Research Question and Objective

Saunders et al. (2009) declare that the importance of the research question to the success of the research cannot be overstated, it should be clearly expressed, must be of appropriate scope and must be “just right for investigation at this time, by this researcher in this setting” (Saunders et al., 2009, p. 33).

The research objective of this study is to identify and evaluate the factors that affect the adoption of CC in Irish hospitals. To achieve this objective, the research will consider the following research question: What are the factors which most affect the adoption of CC in Irish hospitals?

The study will establish and analyse the determinant factors in through an exploratory process contextualised theoretically in the TOE technology adoption model (Tornatzky et al., 1990) and operationally through a review of secondary sources. To aid in the development of the research, three sub-questions, based on the TOE model, will be addressed:

1. What are the technological factors that affect CC adoption in Irish hospitals?
2. What are the organisational factors that affect CC adoption in Irish hospitals?
3. What are the environmental factors that affect CC adoption in Irish hospitals?

The parameters for these TOE contexts are synthesised from the existing CC adoption literature.

The technological context of the TOE framework is comprised of the characteristics of a technology that influence an organisations adoption of innovations, typical technological factors
are perceived benefit, complexity, compatibility, cost and data security (Gangwar et al., 2014; Lian et al., 2014; Oliveira and Martins, 2011)

The organisational context of TOE refers to largely descriptive measures such as firm scope, firm size, resources, innovativeness and managerial perspectives and beliefs that influence adoption via formal and informal mechanisms and structures. (Gangwar et al., 2014; Lian et al., 2014; Oliveira and Martins, 2011)

The environmental construct within the TOE model incorporates the competitive and operational context in which an organisation conducts its business and operations. Significant variables that can be considered include competitive pressure, trading partner pressure, vendor support, environmental uncertainty, regulatory and legal pressure. (Gangwar et al., 2014; Lian et al., 2014; Oliveira and Martins, 2011)

1.3 Research Scope and Limitations

This study focuses on the factors that affect the adoption of CC in hospitals operating in the Republic of Ireland (RofI). For the purpose of this study all service and deployment models of CC will be in scope and likewise all hospitals based in the RofI will be considered.

As such, other health care operators, such as GPs, pharmacies and other sectors, such as the pharmaceutical industry are beyond the scope of this research. Likewise, the research is restricted to only those hospitals operating in the RofI. Thus survey respondents will have direct experience and knowledge of Information and Communications Technology (ICT) in general and CC specifically as it pertains to Irish hospitals.
CC, as per the NIST definition, constitutes the pertinent technology domain, therefore individual technologies that are part of or enable CC, such as virtualisation or the internet, will only be in scope in so far as they are relevant to CC.

![Diagram](image)

Fig. 4 Illustration of the research scope

### 1.4 Research Context

The Health Services Executive (HSE), recognising that CC will be important in the move to a services orientated health infrastructure, declared, in June 2016, that Ireland will create a Health Cloud First policy. In practical terms, this will mean that all new ICT systems that public hospitals in Ireland procure must initially be evaluated as cloud solutions and any non-cloud type solutions will require specific justification prior to approval. This paradigm shift in the approach to HIT in Ireland is designed to allow hospitals to access innovative information systems that, in light of the investment climate that hospitals operate in, may not be affordable otherwise. (Cullen, 2016)
The impetus for this important policy departure for Irish healthcare, and the research it is based upon, has come from the European Cloud in Health Advisory Council (Cullen, 2016). They are calling on policymakers to harness the power of cloud in Europe’s health ecosystem via four practical steps including “a call for a greater emphasis on cloud-first as the default delivery option and other high-profile ways of ‘leading by example’ via pro-cloud policies by Europe’s stakeholders such as the Commission” (HIMSS Europe, 2016).

The four steps are derived from the four recommendations in a Microsoft whitepaper (Microsoft, 2016) that advocates that “EU institutions and Member States governments should issue clear “Cloud First” directives to European healthcare organizations” and suggests that such declarations could be made at the June meeting of eHealth Week 2016. The June meeting of Cloud in Health Advisory Council saw the launch of the HSE’s cloud first policy (Cullen, 2016) and was headed by Microsoft (HIMSS Europe, 2016).

As the cloud first policies and call to action are relatively recent and do not appear to be based upon independent academic research, there exists various opportunities for research to help understand the rationale and consequences of such policies. This research can support the transition to a cloud first ecosystem by helping the stakeholders understand the determinant factors of adoption in hospitals.

With regard to an understanding of the factors which may affect CC adoption the Microsoft whitepaper (Microsoft, 2016), which formed the basis for the cloud first call to action, notes only that despite its many advantages CC is in relatively early stages in the healthcare sector. The report cites sometimes out-of-date regulations, and differing views and understandings of the regulatory environment by regulators, healthcare providers and cloud service providers as the
reasons for this lack of development. The Microsoft report appears to represent the extent of the research supporting the cloud first policies. The rise in CC usage in hospitals, which the cloud first policy is intended to prompt, should be supported by independent academic research. This research intends to address the gaps in the knowledge concerning determinant factors of cloud computing adoption in Irish hospitals.

The intended audience for this research will be stakeholders relevant to the operationalisation of the cloud first policy including hospital administrators and IT professionals, healthcare policymakers, clinical informatics executives and IT vendors seeking to understand the cloud evaluation process for Irish hospitals. It is anticipated that this research will be of practical value to those stakeholders as the cloud first policy becomes an operational reality. In addition, it is hoped that this research will be of academic interest to those seeking to further the body of research on CC adoption, specifically within the domain of hospitals and healthcare.

The aims of this research are to identify and evaluate the technological, organisational and environmental factors that impact the adoption of CC in Irish hospitals. Through a greater understanding of these factors the various stakeholders may be better able to respond to the drivers and barriers and thus to successfully scope, propose, evaluate and implement cloud solutions (Nkhoma et al., 2013).

CC plays a critical role in enabling the high quality, digitally mature patient care, these positive effects will only be fully realised if and when CC is widely spread (Calabrese and Cannataro, 2015; Griebel et al., 2015). It is essential to understand the complex determinants of the diffusion of CC so that the stakeholders, such as those impacted by the cloud first policy, can rigorously
evaluate their migration to the cloud based on independent research (Sulaiman and Magaireah, 2014).

Globally, while research into influencing factors is abundant, consensus on which factors influence adoption remains elusive (Salah Hashim et al., 2015). Specifically, there remains a need for further research into hospitals (Lian et al., 2014; Salah Hashim et al., 2015) as CC implementation remains low in comparison to other sectors despite the potential for enabling improved patient outcomes (Calabrese and Cannataro, 2015; Peng et al., 2014). The prevalent focus of CC research in the healthcare domain, such as Calabrese and Cannataro, (2015) and Griebel et al. (2015) remains on the technological context of CC. Sulaiman and Magaireah (2014) identified that the research has largely ignored the environmental and organisational factors, that are critical to CC diffusion rates in healthcare. In addition, the environmental and organisational factors are more prone to variation than the technological factors (Sulaiman and Magaireah, 2014), thus those factors identified in the studies of Jordanian hospitals (Harfoushi et al., 2016; Sulaiman and Magaireah, 2014) and Taiwanese hospitals (Lian et al., 2014) may not be transferable to the Irish context and thus require research in Irish hospitals.

Carcary et al (2014) identified that the focus in Ireland has been on the enterprise sector and while their own research (Carcary et al., 2014a, 2014b) provides comprehensive insight into the SME (Small and Medium-sized Enterprises) sector, the healthcare sector in Ireland remains unexplored from a CC adoption perspective. Lian et al (2014), in their research on Taiwanese hospitals, recognise that as operating environments vary internationally, future research enabling cross country comparisons within the hospital sector would be beneficial.
1.5 Dissertation Organisation

This paper presents the findings of exploratory research into CC adoption in Irish hospitals. Having introduced the research background, aims and scope in the opening chapter, Chapter 2 presents a structured review of the existent literature as relevant to the research domain and objectives.

In Chapter 3, the primary and secondary research design will be described and the rationale for the design will be expounded.

Chapter 4, data analysis and findings, will parse the data generated by the primary research and will present the significant findings and emergent themes therein.

In Chapter 5 the results of the research will be interpreted in greater detail and the implications of the significant findings will be reviewed.

Chapter 6 will summarise the findings, seeking to draw general conclusions and provide constructive analysis in terms of the issues and concepts that the research seeks to address.

Finally, the researcher will present a critical self-assessment of the learning experience and journey during the production of this dissertation.
2 Literature Review

This chapter will provide context to the objectives of this research by examining the existing literature on the topic and presenting the primary themes and theories in a structured manner. By exploring the prominent and relevant themes of the literature, the findings and conclusions of this research can be better related to the body of existing knowledge and thus can enhance that knowledge. An additional objective of this review is to provide a theoretical foundation upon which to construct this research, identifying trends, discussions and gaps. Finally, the review was essential in improving the researcher’s own knowledge of the topic, particularly pertaining to the hospital environment.

The literature review, the methodology and the objectives of this research were dynamic, interconnected elements in an iterative process whereby the objectives and methodology were repeatedly refined and ultimately informed by the ongoing literature review (see fig. 5). As the literature review evolved, the research objectives matured and the methodology ultimately emerged in its final form.

This review used a structured approach to searching several resources, mainly Google Scholar, EBSCO, Emerald Insight, Dublin Business School library catalogue and the public internet. Although ad-hoc searches were made, typically search terms were formulated and recorded in the research diary (see Appendix F) in an effort to improve the search process.

Saunders et al. (2009) suggest that an appropriate approach is to use the literature review to examine “how far existing published research goes in answering your research question” and by providing a structured critique of the literature, this research will seek to do that.
The objective of this research is to examine the factors affecting the CC adoption decision in Irish hospitals and this literature review will take a structured approach to presenting the extent of our current knowledge in this regard. The conclusion of this review will demonstrate how this research is a valuable addition to both the existing literature on CC adoption in hospitals, and also to the CC adoption research in Ireland.

Fig. 5 Illustration of the iterative approach to research construction (Saunders et al., 2009)
2.1 Technology Adoption Theories

Cavusoglu et al. (2010) classified technology diffusion theories into macro diffusion studies and adopter studies. Macro diffusion examines the empirical rate and pattern of adoption while adopter theories deal with the identification of drivers and barriers of the adoption of the technology. The study and understanding of technology adoption is crucial to encouraging the wider use of technologies that are vital to fostering competitiveness and economic growth (Oliveira and Martins, 2011). With regard to the context and goals of this research, the following section of the literature review will consider only the technology adoption theories branch.

The field of technology adoption research has a long and diverse history and interest has not been limited to merely IS researchers: the broader business, managerial, sociological and economic research communities all contribute to the ongoing discussion, addressing three basic research questions (Fichman and Carroll, 2000):

- What determines the rate, pattern and extent of diffusion of an innovation across a population of potential adopters?
- What determines the general propensity of an organisation to adopt and assimilate innovations over time?
- What determines the propensity of an organisation to adopt and assimilate a particular innovation?

Within the context of technology adoption, it is the last of these three questions that this research is focussed on. Using the TOE adoption model to answer the research question, what are the factors affecting the adoption of CC in Irish hospitals?, this research will further the
understanding of what determines the propensity of hospitals to adopt and assimilate CC. Gangwar et al (2014) in their purposeful review on IT adoption studies utilise a working definition of technology adoption as the “first use or acceptance of a new technology or new product” as that technology pertains to an individual or organisation. In their study they examine a number of the primary theories designed to explain technology adoption, including:

- DOI (Diffusion of Innovation) (Rogers, 1995)
- TAM (Technology Acceptance Model) (Davis, 1989)
- TOE (Technology-Organisation-Environment) (Tornatzky et al., 1990)
- UTAUT (Unified Theory of Acceptance and Use of Technology) (Venkatesh et al., 2003)

In Salah Hashim et al. (2015), a literature review of studies examining the factors affecting cloud adoption, adoption theories were ranked by frequency of use across the domain. It was found that TAM and TOE theories were the most frequently utilised, followed by DOI and finally UTAUT, the least popular being used in only 3 of the 25 studies reviewed. It is unclear why they were only able to use 25 studies when, writing in 2016, Bayramusta and Nasir found 45 CC adoption papers, the largest field of research in the CC domain. Variances in their respective delineations of the domain scope may have impacted the disparity, however enough detail is not provided to make a definitive comparison. The findings of Salah Hashim et al. (2015); that TAM, TOE and DOI are the most prevalent theories used in CC adoption studies, remain instructive and consistent with the research of El-Gazaar (2014) and Gangwar et al. (2014 and 15). However, their study does omit an important theory integration theme identified by El-Gazaar (2014).
In their larger review, of 51 articles, on cloud adoption El-Gazaar (2014) found that TOE was the most frequently used model, used in 11 studies, followed by DOI and TAM with 6. However, their most valuable insight was that the majority of articles used a combination of multiple theoretical perspectives to gain more insights about adoption factors and processes. Their important implication, that the integration of multiple is suited to complexity of the cloud computing adoption phenomenon, is also supported by the studies of Gangwar et al. (2014 and 15).

With regard to the context and objectives of the research, only DOI, TOE and TAM theories will be advanced further in this review. The UTAUT model operates primarily at the user level and has been infrequently utilised in CC research (Oliveira and Martins, 2011; Salah Hashim et al., 2015).

2.1.1 DOI

Oliveira and Martins (2011) reviewed firm level adoption models noting the importance of IT to competitiveness and therefore the necessity to understand the determinants of IT adoption. Their entirely uncritical review describes DOI as a theory of how, why, and at what rate technologies spread, a model operating at both the individual and firm level utilising the concepts of adopter categories, S-shaped adoption curve and adoption predictors.

Writing in 2000, Fichman and Carroll provide a sterner critique of the DOI model, finding that while DOI has had a profound role in shaping the basic concepts, terminology, and scope of the
domain, it is less applicable to more complex technologies where adoption decisions are synergised from many factors.

Sallehudin and Razak (2015), in critiquing the technological characteristics of the DOI model, namely relative advantage, compatibility, complexity, trialability, and observability, found that the characteristics focus on the primary objective features of the technology itself rather than the subjective features operating on the perceptions of the adoption decision maker. However, their subsequent contention that this theoretical weakness could be mitigated by the inclusion of a measure of innovativeness was not robustly justified.

Gangwar et al. (2014) in their review of IT adoption, found that the DOI factors were identical to the technology and organisation context of the TOE framework while the inclusion of the

![Diagram](image)

**Fig. 6** The combined TOE+DOI adoption model developed by Alkhater et al. (2014)
environmental construct missing from DOI makes TOE the superior theory. The position of Low (2011) and Oliveira and Martins (2011), who find that the TOE model is consistent with DOI and can accommodate and extend the DOI factors, is a more nuanced approach than Gangwar’s et al (2014) position that they are identical. Gangwar’s et al (2014) position that DOI is the inferior theory resulted in them not advancing further analysis, preferring to concentrate on the merits of their own integration of TAM and TOE models.

Integration of models is a recurrent theme throughout the research domain. Alkhater et al. (2014) in their investigation of CC adoption developed their own integration of the TOE and DOI models in order to include what they perceived to be the critical factors from DOI (see fig. 6). Their failure to justify the exclusion of the DOI factor of trialability from their model is particularly unfortunate considering that “pay as you use” is a defined feature of CC that lends itself very well to trials of service. Though the Alkhater et al. (2014) paper lacked any evidence of primary research, or methodology and is essentially a primer on their integrated model it does indicate a typical integrationist approach to adoption theories.

Other criticisms of the DOI model include the lack of a role for opponents of diffusion (Cavusoglu et al., 2010) and the observation that compatibility and relative advantage have both been dealt with so broadly and inconsistently in the literature as to be difficult to interpret (Davis, 1989). Relative advantage is very much an inclusive construct, covering cost, security, flexibility, reliability and a variety of other gains (Alshamaila et al., 2013; Lian et al., 2014). This inclusive, holistic interpretation of the relative advantage context coupled with inconsistency in findings amongst researchers, raises validity issues. Lian et al. (2013) and Low et al. (2011) both
failed to find that relative advantage of CC had any bearing on the adoption decision in contrast to the findings of Gangwar et al., (2015) and Safari et al., (2015).

2.1.2 TAM

TAM seeks to explain technology adoption via the causal relationships between the concepts of PU (Perceived Usefulness) and PEU (Perceived Ease of Use) that determine actual usage behaviour and is often considered the most influential and frequently utilised theory in IS research (Burda and Teuteberg, 2014; Gangwar et al., 2014). Davis (1989) defined PU as "the degree to which a person believes that using a particular system would enhance his or her job performance" and PEU as “the degree to which a person believes that using a particular system would be free of effort” (Davis, 1989). As can be deducted from the nature of the 2 constructs TAM is more relevant to the individual level of adoption studies (Oliveira and Martins, 2011; Stieninger and Nedbal, 2014).

Although likely influenced by their own objective of advocating the integration of TAM with other models, specifically the TOE framework, Gangwar et al (2014) provide a coherent analysis of the weaknesses of the model. Relevant to this researcher’s objectives is the criticism that the two constructs, PU and PEU, lack the flexibility to explore the adoption factors of innovative technologies, such as CC, and fail to account for such critical variables in the adoption process as security, trust and firm size (Gangwar et al., 2014; Stieninger and Nedbal, 2014). Further, they
also cite the failure of the model to include macro level impacts such organisational agility and financial performance as potential components to the adoption decision.

It is these weaknesses, in addition to the flaws they identify in the findings of TAM based research, that Gangwar et al. (2014) utilise to justify their integrated TOE-TAM model. While their justification for their integrated model is well constructed and sound, their failure to present a clear and concise picture of that integrated model means that while they successfully achieve their primary goal of reviewing IT adoption theories, they fall short in their secondary goal of presenting an integrated TAM-TOE model.

In term of strengths, the simplicity, parsimoniousness and ability, through repeated empirical testing, to predict up to 40% of variance in individual’s intention to use technologies are cited (Burda and Teuteberg, 2014; Gangwar et al., 2014). However, considering the exploratory and qualitative nature of this research, in addition to its organisational level perspective, it is doubtful that these strengths will significantly advance the research goals.

2.1.3 TOE

TOE is one of the most widely used of the adoption theories, operating at organisation level, it holistically models how the three major contexts: technology, organisation and environmental influence innovation adoption and implementation (see fig. 7) (Baker, 2012; Gangwar et al., 2014; Ray, 2016).
Fig. 7: The TOE innovation adoption framework (Tornatzky et al., 1990)

Using these three contexts to holistically model the adoption of innovations, the framework is consistent with DOI theory and so there tends to be significant overlap in factors examined between the two models (Baker, 2012; Low et al., 2011; Salah Hashim et al., 2015). This is particularly true with regard the DOI factors of relative advantage, complexity, and compatibility which are often used in TOE studies (Borgman et al., 2013).

The TOE framework is favoured by researchers for its ability to better explain the external drivers and barriers to adoption (Oliveira and Martins, 2011) but its main strength appears to be the latitude researchers have in choosing the factors to include under the three general contexts (Baker, 2012; Borgman et al., 2013). This flexibility enables its application to many adoption research contexts, organisations or industries and ensures its popularity. While factors thus
inevitably vary across the domain, the factors used by the purposeful Alshamaila et al. (2013) study are typical (see fig. 8).

Fig. 8: TOE factors which affect the CC adoption decision (Alshamaila et al., 2013)

However, in the view of this researcher it is this very flexibility that results in the primary weaknesses of the TOE model, being in effect a generic framework upon which can be hung any number and variety of factors rather than a robust theory capable of prediction. The three major constructs of TOE thus operate to form a typology for the various factors within them. This holistic perspective prompted Gangwar et al (2014) to posit that “there is a requirement of a more robust framework to study organisational adoption”. In Baker’s (2012) critique of the model, this flexibility is cited as having stunted its development as researchers have little impetus to adjust or refine the theory as it so easily fits into all scenarios.

It is the view of this researcher that the impact of the weakness can be lessened, and the risks to validity mitigated, through the application of the model in exploratory studies where understanding supersedes generalisability as a research objective. An example of such research is
the seminal work by Alshamaila et al (2013) which used TOE as a theoretical base for their qualitative exploratory study of CC adoption in the north east of England. They present a strong and coherent justification for the use of TOE, citing its holistic view of adoption determinants as particularly suitable to their exploratory study.

Their methodology, however, of presenting their respondents with the TOE factors at the start of the interview may cause validity issues arising from risk of bias in the interviews where respondents seek to conform to their perception of social norms (Saunders et al., 2009). In this regard, it is notable that in Carcary’s et al (2014a; 2014b) studies on SMEs in Ireland, a culturally similar domain, there is very little overlap in findings. The fact that Alshamaila (2013) presents so few direct quotes makes it difficult to assess the quality of their analysis and indeed their perception of what constitutes significance.

2.2 Adoption of Cloud Computing

Writing in 2016, Bayramusta and Nasir found that adoption studies, which they defined as “articles that study how to adapt the CC to current business solutions” was the most populous field of study within the CC domain, accounting for just under 20% of the articles they categorised. A number of issues undermine their work such as a failure to address the question posed in the articles title: A fad or future of IT? and misinterpreting their findings e.g. stating that the majority of the CC research were studies of adoption when in fact, although the largest category, it comprises only 20% of the total. Despite these failings, the illustration of the prominence of adoption studies within the domain clearly demonstrates the focus that is being dedicated to the adoption of technologies.
The approach of Safari et al., (2015) in selecting factors from multiple adoption theories, TOE and DOI in their case, is typical of the domain and is to be found in other studies including Gangwar et al. (2014), Oliveira and Martins (2011), Stieninger and Nedbal, (2014). Despite their ill-defined research aim: “to provide a good insight into SaaS technology adoption” and a small sample size, their study examined and ranked the factors that influenced adoption. Their findings, that relative advantage, competitive pressure, security and privacy, collaboration and social influence are the top 5 determinants, are also not untypical of the domain. For example, in their review of the literature, unfortunately limited to a mere 25 articles despite the abundance of adoption literature, Salah Hashim (2015) identified the top 5 factors as security and privacy, relative advantage, compatibility, complexity and ease of use. Similarly, Stieninger and Nedbal, (2014) identified relative advantage, image, complexity, compatibility, security and trust as the top 5 determinants of CC adoption. Their study, most useful for their comprehensive operationalisation of the 5 factors is again typical in its adoption of factors from multiple theories, in this case DOI and TAM. However, despite neither of these theories specifying security and trust as a construct, the authors included the factor with little justification and may thus have been better served by employing the flexible TOE model for their purposes.

A number of literature review studies, such as Gangwar et al. (2014) and Trivedi (2013) are dedicated to exploring emergent factors from existing research and are unified in finding the prominence of TOE and DOI concepts. Oliveira and Martins (2011) claim that their review is exhaustive, but their repeated citing of their own research skews their findings strongly in the direction of factors, such as perceived benefits of electronic correspondence, which they themselves repeatedly use in their studies undermines the value of their review.
The study by Nkhoma et al. (2013) takes a untypical approach in a number of ways. First they use only secondary data, basing their research on an IBM survey; second they utilise factors such as compliance and extendibility (see fig. 9) and finally, although they use the TOE model, they conceptually categorise factors into benefits and barriers and measure their impact on adoption with adopter’s style as a moderating factor. If their approach is untypical, so were their findings. They failed to find a statistical relationship between their constructs and adoption. Their choice of a secondary data set may be instructive in understanding these findings.

Iye et al. (2013) carried out a sectorial analysis of determinants across 4 sectors, including hospitals. The study presumes that the four risk variables chosen (vendor related risk, security related risk, no-gain risk and efficiency related risk) are “reasonably comprehensive” however, they provide insufficient evidence to support their claim. In contrast, Dutta et al (2013), through a systematic review of existent sources, compiled a 39-point risk ontology and, although undermined by a small sample, a common theme through much of the literature, they found that current legal and technical complexities and deficiencies were the predominant risks.
Iye et al. (2013), comparing risk profiles across the SME (Small Medium Enterprises), BFS (Banking & Finance sector), Education and Hospital sectors identified “remarkable similarities” between hospitals and BFS, both sectors rating security and efficiency risks highly, while being relatively unconcerned by no-gain and vendor risks. The study unfortunately fails to operationalise the risk categories but it is apparent that efficiency risk includes reliability related risks which could help explain the primacy of these concerns in BFS and hospitals.
2.3 Cloud Computing in Hospitals

The healthcare sector is often considered to be a laggard in terms of technology adoption (Khoumbati et al., 2006; Peng et al., 2014) however there exists an abundance of research across the spectrum, from the adoption decision through to practical implementations.

Writing in 2011 on the opportunities and challenges of CC to improve health care services, Kuo finds that CC offers flexibility, less expense, and potential opportunities for improving EHR (Electronic Health Record) adoption and health care services. Although more a discussion paper than primary research, in identifying data security and legal issues as the strongest resistance to the adoption of CC in health IT, it does anticipate the direction of the security focused future research.

In their comprehensive review of healthcare CC applications, Calabrese and Cannataro (2015) also identify data security and privacy as the most important challenge for CC in healthcare. In their review of the literature, Griebe et al. (2015) analysed 102 publications for implementations of CC technology, finding that only 14 concerned successful implementations while the remainder were conceptual in nature. Their unjustified decision to limit their search to the MEDLINE database may have had some implications for their findings considering the abundance of applications reviewed by Calabrese and Cannataro (2015). As their concern was with applications of CC they do not mention adoption studies specifically but they do cite security and privacy concerns as being probable barriers to adoption.

Security and privacy concerns are a recurrent theme throughout the literature on CC in hospitals and healthcare. In their analysis of privacy and security issues for mobile health platforms, Harvey & Harvey (2014) find that the dynamic and fluid nature of data in CC environments
exacerbates the difficulties of protecting sensitive data (see fig. 10). Although CC is well suited to eHealth services, they caution that the benefits can be overshadowed by risks which require the integration of security technologies across the diverse security architecture contexts.

Fig. 10: Illustration of security and threat contexts in mobile health (Harvey and Harvey, 2014)

In their analysis of the security and privacy requirements of cloud-based EHR Systems, Rodrigues et al. (2013) and Harvey and Harvey (2014) both find that cloud is an effective enabler of the eHealth paradigm and that the critical element of a successful implementation is attaining the balance between acceptable risk and financial cost. Whilst Harvey & Harvey (2014) make thorough recommendations for device and client side security measures, the recommendations and analysis of Rodríguez et al (2013) for role-based access, network security mechanisms, data encryption, digital signature and monitoring of system access constitute a more valuable framework for enterprise decision makers.
Both Harvey and Harvey (2014) and Rodríguez et al (2013) adhere to the consensus that security and privacy represent the most pressing issues for decision makers considering CC adoption. However, the fact that they do this without supporting evidence or references risks the creation of a received wisdom and indeed a self-fulfilling prophecy whereby decision makers must devote the majority of resources to data security per the recommendations of such studies.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Context</th>
<th>Adoption Theory</th>
<th>Factors</th>
</tr>
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<tbody>
<tr>
<td>Lian et al (2013)</td>
<td>Private cloud in Taiwan’s larger hospitals</td>
<td>TOE+HOTHi</td>
<td>CIO innovativeness; Perceived technical competence; Data security; Complexity; Compatibility; Cost; Relative advantage; Top manager support; Adequate resource; Benefits; Government policy; Perceived industry pressure</td>
</tr>
<tr>
<td>Ermakova (2015)</td>
<td>Physicians Adoption of CC</td>
<td>None</td>
<td>Performance expectancy &amp; security and privacy concerns</td>
</tr>
<tr>
<td>Harfoushi et al (2016)</td>
<td>CC in Jordanian hospitals</td>
<td>TOE</td>
<td>Relative Advantage; Complexity; Compatibility; Top management support; Technological readiness; Competitive pressure; Trading partner pressure; Vendor scarcity</td>
</tr>
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Fig. 11: Studies investigating the factors affecting CC adoption in hospital contexts

Four studies were found that objectively addressed the factors which impact adoption in the hospital context (see fig 11). The first, Lian et al (2013) investigated the critical factors affecting the adoption of private cloud in Taiwan’s larger hospitals. The study uses a modified TOE framework, whereby the human context is added as a fourth dimension to the TOE model, when
normally human elements, such as senior manager support, are included in the organisational context (Alshamaila et al., 2013; Harfoushi et al., 2016). This modification of the TOE model appears even more unnecessary given the findings of their quantitative study revealed the top 5 determinants to all be regular TOE elements: data security, perceived technical competence, cost, top manager support, and complexity. Further, their finding that relative advantage and the benefits of adopting CC technology are “relatively unimportant to hospitals” is quite unrepresentative of both the literature on hospitals (Griebel et al., 2015; Kuo, 2011; Peng et al., 2014) and adoption literature generally (Alshamaila et al., 2013; Gangwar et al., 2014; Safari et al., 2015).

Fig. 12: Role-based access to EHR depending on the type of user of the Health Cloud (Rodrigues 2013)

In the second study on adoption in hospitals, Harfoushi et al (2016) used a questionnaire to measure the impact of 8 TOE factors (see fig. 13) had on adoption in Jordanian hospitals. While
the methodology was sound, the sample size functional and the theoretical foundation solid, their decision to only test the three major constructs (technology, organisation and environment) significantly limits the usefulness of their findings. The results of their study, that the three major constructs do impact the adoption decision, are of limited value to the research community and difficult to critique other than to observe that they are not inconsistent with the other studies.

![TOE model](image)

**Fig. 13:** The TOE model used to examine CC adoption in Jordanian hospitals (Harfoushi et al., 2016)

The third study to directly examine adoption determinants, Ermakova (2015), finds that healthcare professionals evaluate two conflicting beliefs, performance expectancy and security concerns, when evaluating CC adoption. The finding, as narrow as it is, is undermined significantly as the paper does not contain sufficient methodological or theoretical information to make a judgement on robustness of method or reliability and validity of findings. Finally, it is not explicitly stated that the research setting was hospitals, although it is implied and this author is confident that it is hospitals.
Finally, Sulaiman and Magaireah (2014) adopted a case study approach to research the adoption of a cloud based EHR system, also in a Jordanian hospital. Their qualitative study, like Lian et al (2013) and Harfoushi et al. (2016), adopted the TOE model and found that that top management support, reliability, privacy, security, government policy, legal environment, technology readiness and competition were all determinants of adoption for CC for EHR. The most coherent of the 4 studies reviewed, their theoretical contextualisation was sound, their inferences appear justified given the inclusion of large amounts of primary data and their conclusions, if somewhat undeveloped, are consistent with their findings and with the broader adoption literature.

2.4 The Irish Context

While some work has been done on CC adoption in Ireland, notably Carcary’s et al (2014a; 2014b) exploratory studies on the SME sector, this researcher could locate no published works on CC adoption in either healthcare broadly or hospitals specifically in Ireland. Evidence was found (Doyle et al., 2015) of a conference presentation on a pilot cloud diagnostic aid for the Irish National Bowel Screening Programme. Their findings, that a digital archive is a feasible approach to the standardisation of diagnosis and a useful adjunct to traditional methods is suggestive of the digital capabilities of CC and the agility and collaboration it fosters (Ben-Zion et al., 2014; Calabrese and Cannataro, 2015; Elena and Johnson, 2015; Harvey and Harvey, 2014). Efforts were made to contact the individuals involved but at the time of writing these attempts have been unsuccessful.

The SME domain is well researched internationally and Ireland is also well serviced in this regard. Carcary et al. (2014a, 2014b) examined two aspects of CC with regard to the SME sector,
their first study an exploratory study on adoption and their second a follow up article on the readiness and benefit realisation of SMEs. The exploratory study aimed to answer three questions, to:

1. Determine the profile of Irish SME adopters and non-adopters of CC
2. Outline the preparatory steps SMEs undertake in CC adoption
3. Discern the constraints to SME CC adoption

![Fig. 14: Barriers to CC adoption in Irish SME sector (Carcary et al. 2014a)](image)

Their lack of theoretical contextualisation is typical of their highly operational perspective, the findings are of significant value to policy makers and vendors seeking to assist the sector adopt innovative technologies. Although their work does examine barriers to adoption (see fig. 14) the lack of a theoretical framework undermines their relatability to the broader CC adoption discourse. Greater comparability between their work and the work of Alshamaila et al. (2013) on CC adoption in the UK SME sector would have potentially added considerable value to the research domain.
Their article on readiness and benefit realisation (Carcary et al., 2014b), based on the same quantitative research, assessed the approaches adopted by SMEs in migrating to the cloud, and the potential benefits SMEs have experienced from cloud computing adoption.

Based on a sample of only 95, their findings have limited generalisability but are nonetheless interesting in terms of the perceived benefits of CC post implementation (see fig. 15). Their findings, that benefits in terms of cost, collaboration and digital capabilities were realised by over 50% of the population, are consistent with healthcare studies (Ben-Zion et al., 2014; Bildosola et al., 2015; Harvey and Harvey, 2014).
2.5 Conclusion

This review has established the extent of the research globally on cloud computing adoption studies. Studies such as Alshamaila's et al. (2013) research on the factors affecting CC adoption in the north east of England helped foster the relatively extensive adoption studies on the SME sector. In terms of broader sectoral analysis the study of Iye et al. (2013) adopted a comparative view across four industry sectors, including the hospital sector. Hospital sector studies can be categorised broadly into research of applied CC instances such as those of (Griebel et al., 2015) and Calabrese and Cannataro (2015) and CC adoption research. It is in relation to the adoption research of Harfoushi et al. (2016), Lian et al. (2014) and Sulaiman and Magaireah (2014), which seek to identify the factors affecting the CC adoption decision in hospitals, that this research is relevant. The existing research has covered hospitals in Taiwan and Jordan, this research seeks to further the existing knowledge geographically by examining the topic within the Irish context specifically. This announcement by the HSE of a cloud first policy for Irish hospitals makes the undertaking of this research particularly timely.

Within the Irish context, the quantitative research by Carcary et al. (2014a, 2014b) has provided valuable insights into the concerns of the SME sector in Ireland, however, the hospital sector has not had the benefit of research as yet. This research will satisfy that gap in the knowledge and by pursuing qualitative methods will deliver a depth of insight and understanding to the Irish context broadly and the hospital sector in particular.
3 Research Methodology and Methods

This chapter will endeavour to explore the methodological choices that have been made in the pursuit of this research, from those that addressed matters of research philosophy to the many practical and operational choices. Conducting research can be considered a process of decision making in response to the many options and questions which arise during the construction of the research (Brannick et al., 1997; Holden and Lynch, 2004; Saunders et al., 2009). The researcher’s choices, made in response to those questions, form layers of abstraction around the research objectives and in this chapter these layers will be peeled back, discussed and evaluated. The objective of this exploration is to reveal and illuminate the various elements of the research in order that the audience may clearly understand the foundations upon which the findings are built.

The first choice researchers will typically make is deciding upon the topic to research, and from this seminal decision will develop the many subsequent choices and selections that will shape the research and determine the quality and soundness of the findings (Saunders et al., 2009). The purpose of this research is to identify and provide understanding of the factors that influence CC adoption in Irish hospitals.

In an effort to make a very complex subject more digestible Saunders et al. (2009) propose the research onion analogy (see fig. 16) to help peel back the layers and this researcher will adopt it as a guide to the journey through the decisions that formed this research.

Knox (2004) considers these philosophical discussions a quagmire that risks inexperienced researchers abandoning it entirely and carrying out research independent of philosophical
awareness. Saunders et al (2009) view a solid philosophical awareness as imperative to understanding what it is we are investigating thus this prospect poses a threat to the quality of the findings.

Fig. 16: The Research Onion, a guide through the various research choices (Saunders et al., 2009)

Saunders et al (2009) go on to posit that the critical issue is to be capable of reflecting upon the philosophical choices and to be cognisant of the alternatives available. Holden and Lynch (2004) states that a review of philosophy is a vital aspect of the research process as it opens researcher’s minds to other possibilities, which can lead to both an enrichment of research skills and an enhancement in confidence in their methodology. Both Holden and Lynch (2004) and Saunders et al. (2009) support the adoption of a pragmatic approach to philosophical considerations by
proposing that researchers can synergise philosophy, methodology and the research problem to construct the research.

Fig. 17: The characteristics of this research’s methodology

An understanding of the research context, which clarifies positionality, relationality, ontology and epistemology, can facilitate methodological decisions most appropriate to the research questions. By presenting and justifying the philosophy, methodology and methods, the integrity of the research, including the ethical dimensions, reliability and validity can be supported and the credibility of the findings enhanced (Jackson, 2013).

This researcher has designed a research schema that, consistent with the researcher’s own beliefs and perspectives, adheres to a pragmatic framework allowing the research objectives and context to be prioritised in the construction of research that is coherent with those beliefs.
3.1 Philosophy

A critical factor in the formation of a research perspective is the personality of the researcher: their attitudes and perceptions are active and utilised in every stage of the decision-making process (Jackson, 2013; Saunders et al., 2009). This researcher possesses a world view that is largely in synch with, and sympathetic to, the interpretivist philosophical tradition which emphasises a complex reality with a subjective meaning constructed through the interactions of the social actors. It can be argued that the researcher’s assumptions mould the research outcomes and the methodological choices “profoundly affects” what is found (Jackson, 2013).

The identification of the research philosophy forms the outer layers of the research onion and is divided by Saunders et al. (2009) into 4 dominant philosophies: Positivism, Realism, Interpretivist and Pragmatism. For studies in the IS realm the most dominant philosophies are Positivism and Interpretivism (WenShin Chen and Hirschheim, 2004) and it is important to have an understanding of one’s position within the epistemological debate between the two philosophies (Saunders et al., 2009; Walsham, 1995).

The interpretivist view, as adhered to by this researcher, is that social reality is a dynamic synergy of the perceptions and actions of the actors within a subjective reality (Saunders et al., 2009). Epistemologically, interpretivism considers that knowledge, which is subjective, is obtained through the understanding of complex attitudes and actions of social actors.

Venkatesh et al. (2013) cite the intense debates surrounding the relative values of the various epistemologies and methodologies in the social and behavioural sciences. WenShin Chen and Hirschheim, 2004 posit that a single philosophical or methodological perspective for studying IS is unnecessarily restrictive and the interpretivist view can add much value to the discourse.
The defining purpose of IS as an academic discipline is to understand and improve the ways people create value with IS (Nunamaker et al., 2015). The ability of interpretivist-based research to provide in-depth understanding and alternative perspectives on phenomena is crucial to achieving those goals (WenShin Chen and Hirschheim, 2004). WenShin Chen and Hirschheim (2004) advocate the pursuit of interpretivist research in the field of IS studies based on that ability to yield profound insights and greater understanding of IS phenomena.

While Walsham (1995) found that the interpretivist perspective was gaining ground in IS research by 2004 WenShin Chen and Hirschheim and found that little further progress has been made in the advancement of the interpretivist perspective (see fig. 18). Irrespective of the prevalence of positivist perspectives, it is widely accepted that the epistemological position of the research should be consistent with the research objectives and the exploratory objectives of this research are consistent with and achievable through an interpretivist philosophy (Saunders et al., 2009; Walsham, 1995).
3.2 Approach

Having navigated the outer layer of the research onion, the researcher should now consider their position vis-a-vis what Saunders et al. (2009) term the “approach to research”. Essentially, the researcher can elect to operate via inductive reasoning, where data collection is followed by theoretical contextualisation and development, or deductive reasoning where hypotheses, developed from existent theory, are tested through the collection and analysis of data (Saunders et al., 2009).

Research formulated upon inductive paradigms emphasises the complex contexts of human actions and research environments and, as such, is generally aligned with the interpretivist epistemologies more prevalent in social sciences (Park and Park, 2016; Saunders et al., 2009). Inductive research seeks to understand the research context, is less concerned with generalisable results and, although attempting to control it, is accepting of the researcher’s role and their potential biases in the research.

<table>
<thead>
<tr>
<th>Deduction emphasises</th>
<th>Induction emphasises</th>
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<tr>
<td>scientific principles</td>
<td>gaining an understanding of the meanings humans attach to events</td>
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<td>moving from theory to data</td>
<td>a close understanding of the research context</td>
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<tr>
<td>the need to explain causal relationships between variables</td>
<td>the collection of qualitative data</td>
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<td>the collection of quantitative data</td>
<td>a more flexible structure to permit changes of research emphasis as the research progresses</td>
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<td>the application of controls to ensure validity of data</td>
<td>a realisation that the researcher is part of the research process</td>
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<tr>
<td>the operationalisation of concepts to ensure clarity of definition</td>
<td>less concern with the need to generalise</td>
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<td>a highly structured approach</td>
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<td>researcher independence of what is being researched</td>
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<td>the necessity to select samples of sufficient size in order to generalise conclusions</td>
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Fig. 19: Characteristics of the deductive and inductive approaches (Saunders et al., 2009)
Subsequent to a review of the literature, and cognisant of the exploratory objectives of the research, this researcher chose to conduct an inductive based study. While largely agnostic in terms deduction or induction approaches, the extent and quality of the research specific to the question of CC adoption in hospitals suggested an inductive approach would be of greater value at this time.

This approach is consistent with the epistemological perspective of the researcher and also with the finding of the literature review, where no absolute consensus exists in terms of either theoretical framework or determinant factors for CC adoption studies generally and in the hospital setting particularly. Due to the exploratory nature of this study, in a relatively immature and sparsely populated research domain centred on a rapidly evolving technology, it is this researcher’s belief that greater value and insight can be generated through the inductive approach.

Inductive research is capable of generating understanding of a phenomenon from small samples where deductive research would require larger samples to describe a phenomenon, attain validity and generalisable results (Saunders et al., 2009). The application of the TOE technology adoption framework, which is highly adaptable with interchangeable factors lending itself to exploratory studies in specific industry sectors (Gangwar et al., 2014), is consistent with inductive research and is expected to facilitate the creation of insights from the respondents.

3.3 Design

3.3.1 Research Choice & Strategy
Researchers must seek to make decisions that will enable them to best answer their particular research questions and, having considered their worldview, philosophical perspective and research approach, the researcher must now make practical decisions that will also fundamentally impact the quality and effectiveness of their research (Saunders et al., 2009).

Continuing with the research onion as the guide through this decision-making process the first of these ‘practical’ decisions concerns the choice of strategy. The research strategy is how the researcher intends to carry out the research, and when selecting a strategy consideration of the research goals and worldview of the researcher are both influential. The chosen strategy should be a synthesis of these factors and, ultimately, the critical aspect of any chosen strategy is that it should enable the researcher to answer the research question (Bryman, 2004; Saunders et al., 2009).

![Frequency of research choices in IS research](image)

Fig. 20: Frequency of research choices in IS research (WenShin Chen and Hirschheim, 2004)
This research, in attempting to provide insight and understanding into the factors that influence CC adoption, is exploratory in purpose, and the choice of interviews as a research strategy is appropriate to achieving that goal (Brannick et al., 1997; Saunders et al., 2009). The pursuit of interviews is also appropriate to IS research and, where understanding is the goal, often preferable to empirical survey methods (Park and Park, 2016; WenShin Chen and Hirschheim, 2004). The exploratory aims of the research in conjunction with the interpretivist world view of the researcher make the interview as a choice of research strategy a sound basis upon which to build the remainder of the research edifice.

Again, in terms of the research onion, subsequent to the selection of the research strategy is the selection of what Saunders et al. (2009) call the research choice, by which is meant the way a researcher chooses to “combine quantitative and qualitative techniques and procedures”. At this juncture in the construction of the research schema, the researcher either elects to employ multiple-methods (where some combination of quantitative and qualitative methods is utilised) or mono-methods data collection technique (the use of either quantitative or qualitative methods).

Mono-methods research will utilise solely either quantitative or qualitative research methods in the pursuit of the research objectives. Quantitative methods are comprised of data collection techniques that yield or use numerical data, such as questionnaires and other empirical data collection techniques (Saunders et al., 2009). Conversely, qualitative methods generate non-numerical data such as interview responses and are more widely used in the social sciences (Saunders et al., 2009).
Qualitative methods are useful for theory building (Singh, 2015) and most appropriate for exploratory studies (Brannick et al., 1997; Park and Park, 2016; Saunders et al., 2009; WenShin Chen and Hirschheim, 2004), and typically are used where smaller samples are likely (Robinson, 2014). This combination of characteristics and capabilities make qualitative methods the optimum choice for achieving the objectives of this research. However, the weaknesses, such as those pertaining to generalisability must be acknowledged.

Mixed-methods research combines quantitative and qualitative methods, ideally such that the strengths of each method are emphasised and the weaknesses mitigated in a single study (Wardale et al., 2015). Mixed-methods research has achieved increasing popularity amongst practitioners to such an extent that they are now considered the ‘third methodological movement’ after mono-method quantitative and qualitative methods (Venkatesh et al., 2013; Wardale et al., 2015).

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<tr>
<td>Assumed human behaviour from the informant’s perspective</td>
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<td>Assumes a dynamic and negotiated reality</td>
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Fig. 21: Comparison of Qualitative and Quantitative research methods (McLeod, 2008)
Consistent with the other design and construction options faced by researchers, there is no ideal research choice. Both options have their merits, so the decision must be based upon the research context and goals (Venkatesh et al., 2013).

The objectives of the current research, to explore and identify the factors that affect the adoption of CC in Irish hospitals, are achievable through mono-method qualitative research and while a mixed or multi-method approach may add another dimension to the research, the research context does not encourage the use of multi-methods. While not impossible in the time frame available to complete this research, the pursuit of multiple-methods does put significantly more pressure on resources in terms of time and skill (Saunders et al., 2009). Thus with regard to the capability of mono-method qualitative research to achieve the research objectives and in light of the questionable additional benefits of multi-methods in furthering those objectives, mono-method qualitative research has been selected as the optimum research choice.

### 3.3.2 Sampling

Sampling is an important factor in the construction of qualitative research, and often receives less attention than it warrants (Robinson, 2014). A sample is a subset of a population, selected to be representative of that population where it would not be practical or possible to study the entire population (Acharya et al., 2013).

The research population was defined, as suggested by (Feinberg et al., 2012), in terms of elements, sampling units, extent and time frame as illustrated in figure 22.
The inclusion criteria used to define the sample universe was knowledge and experience of IS in Irish hospitals, and knowledge and involvement in CC implementation and management. Levels of knowledge of CC were assessed via individual’s LinkedIn profiles, using their job titles, job descriptions, employment history and their list of skills to form an opinion on their expected level of expertise of CC. In the case of individuals with job titles such as IT Manager, CIO, Head of IT or, in the case of clinical technology specialists, with skills such Cloud Computing, Enterprise Software, Digital Strategy etc. the level of expertise was inferred.

Therefore, the research population is those individuals having direct responsibility for, or involvement in IS implementation and decision-making processes and having expert level knowledge of CC in the Irish hospital sector. This sampling criteria are illustrated in figure 24.
Because there is no list of individuals, such as a hospital IT managers’ professional association, who would meet those criteria, non-probability sampling technique was employed to select the sample. The major limitations of such a technique, namely the inability to draw statistical inferences about the characteristics of the population (Saunders et al., 2009) is not detrimental to the objectives of this research. Indeed, the ability to ensure that respondents will be information-rich enables the researcher to better explore the research question and gain theoretical insights that random sampling may not necessarily produce (Saunders et al., 2009).

Fig. 23: Sample formation model (Robinson, 2014)

Targeted respondents were chosen through purposive expert sampling, ensuring that participants possessed those levels of knowledge and experience in Irish hospitals, thus enabling the research themes to be fully addressed. Saunders et al. (2009) suggest homogeneous purposive sampling allows for the selection of cases that are particularly informative, thus enabling the study of a
group in greater depth. This form of sampling technique, defined as a “selection of sampling units within the segment of the population with the most information on the characteristic of interest” (Guarte and Barrios, 2006) is appropriate when working with very small samples, particularly where respondents possess in-depth knowledge of the topic. (Baker, 2012; Robinson, 2014).

Drawing from sources, including websites of the Health Service Executive (HSE) and health insurance companies, a list of 64 hospitals in the Republic of Ireland was compiled. Using LinkedIn, 44 individuals listed as working in the 64 hospitals and the HSE in senior roles that fulfilled the sampling criteria including CIOs, managers and technical specialists were contacted. LinkedIn is deemed to be an appropriate tool for population mining and communication (Dutta et al, 2013), though some unanticipated obstacles did arise.

![Population sampling criteria](image-url)

Fig. 24: Population sampling criteria
Ordinary users cannot message individuals on LinkedIn who are not already connections (unless the target user has opted to allow this). In addition, some users possess restricted accounts meaning you cannot invite them to be a contact without some additional knowledge such as their email address or shared employment history. As the planned method of contact for the individuals was to be LinkedIn messaging, these obstacles posed a significant problem at that stage of the research. Essentially, the researcher had a sample but no way of contacting them. By way of solution, a premium LinkedIn account was acquired, at a cost of €117 per month, which allowed the researcher to use the platform to message individuals who were not an already existing LinkedIn contact.

Personalised letters of introduction were sent to all identified individuals (See Appendix B) from which a total of 8 responses were received. Of the 8 responses 5 responses were positive and resulted in interviews. 1 response was positive but failed to attend for interview at the arranged time and did not respond to subsequent communication. 2 responses were initially positive but ultimately stopped responding prior to the arrangement of an interview. It is undeniable, considering the heterogeneous nature of the research context, that additional respondents may have yielded deeper insights and more robust findings. However, Robinson (2014) does suggest this number of respondents is within the acceptable range for studies with ideographic aims, where generalisable findings are not sought, and better allows for individual voices to be heard and for detailed analysis of those voices to take place.

3.3.3 Time Horizon
When conceiving the research architecture, the researcher must choose whether the findings should be based on a snapshot of the research topic as it exists at a particular time, a cross-sectional study, or upon a longitudinal study where the research is carried out over a longer period in time and the measure of change over time is possible.

Based on the research context, namely a hard deadline date and a limited period of time in which to undertake the research, the pursuit of the cross-sectional approach is more practical than a longitudinal study. Further, the addition of a time variable, other than an impractically long time period, into this research is unlikely to add any significant value to the identification and evaluation of CC adoption factors. Longitudinal studies are useful for studying and measuring change over time, allowing the researcher to attain an amount of control over the variables being studied (Saunders et al., 2009). While such objectives may be valuable, they are neither practical within the context nor critical to the objectives of this research. Saunders et al. (2009) suggests the use of historical data and research as one method of introducing a longitudinal element into research, and while this is more difficult and less valuable when studying such recent innovations as CC where the passage of time since research into the topic began may not have been sufficient to allow for measurable change, it is worth considering as the technology matures and becomes more mainstream.

3.3.4 Collection

The core of Saunders’ et al. (2009) research onion is the data collection technique, which is informed by the prior decision to pursue mono-methods qualitative research to provide insight and understanding into the factors that influence CC adoption. The choice of interviews as the
data collection technique for gathering primary data is appropriate to achieving the exploratory objectives (Brannick et al., 1997; Saunders et al., 2009) and is also appropriate to IS research specifically (Park and Park, 2016; WenShin Chen and Hirschheim, 2004).

Saunders et al. (2009) defines an interview “as a purposeful discussion between two or more people” and outlines a number of interview types from which the researcher can select or combine along a spectrum from the informal to the formal. More formal structured interviews utilise standardised questions to minimise researcher bias and collect quantifiable data suitable for explanatory studies (Saunders et al., 2009). At the other end of the spectrum are unstructured interviews where the respondent is allowed talk freely and the interview evolves in an organic manner aiming to better explore the relevant topic (Saunders et al., 2009).

Semi-structured interviews, where the interviewer allows a degree of organic evolution but guides the interview to ensure that certain themes and questions are covered (Saunders et al., 2009) has been chosen as the specific data collection method for this research. Achieving the goal of exploring the adoption of CC requires a depth of response that less formal interviews are likely to generate best while also allowing for supplemental probing questions necessary with such a complex topic (Saunders et al., 2009). Also, given the relatively diverse backgrounds of the respondents, the interviews were tailored somewhat to each interviewee. For example, questions of strategy were relevant to senior managers whilst technical focus lines of enquiry were more appropriate for technical specialists.

Given the hard deadline for the completion of the research and the limited access the researcher had to respondents, the semi-structured format was chosen to ensure that the required themes and areas of interest were fully explored in the limited amount of time available. To better ensure that
the necessary themes would be covered, an interview schedule was prepared (see Appendix E) and, where appropriate, was tailored to suit the knowledge and area of expertise of the respondent.

Fig. 25: The various types of research interviews (Saunders et al., 2009)

Maykut and Morehouse (1994) define an interview guide as a series of topics or broad interview questions which the researcher is free to explore and probe with the interviewee as opposed to a research schedule which is more detailed and may include probing questions also. This researcher considered the schedule more appropriate considering access limitations meant that repeat interviews were unlikely. According to Maykut and Morehouse (1994) good interview questions can be challenging to develop and failings can be categorised as the closed question, the unclear or vague question and the complex question. The schedule was also useful for minimising the risk of these failings.
The guide was developed to ensure that an appropriate perception of professionalism and preparedness was conveyed to respondents and each interview benefitted from a consistency of approach. It was considered important when dealing with senior managers to ensure their time was not being wasted and they felt part of a worthwhile process that was worthy of their input and insight.

Considerations of perception and trust were also heightened by the requirement for telephone interviews. In order to accommodate respondent schedules and long distances involved, three of the interviews were carried out by phone, which Saunders et al. (2009) consider to inhibit important relationship building. The researcher’s efforts to convey professionalism and preparedness in all correspondence coupled with considerable professional experience of daily phone based relationship building is hoped to have gone some way to mitigating these weaknesses. One of the interviews, again due to the long distances involved, was conducted using an internet based video link, and so there were technical considerations, such as laptop power and reliable internet connection to factor into preparation. The final interview in the series was conducted face to face in the offices of the respondent and thus considerations of appearance, body language and eye contact were relevant.

Maykut and Morehouse (1994) consider the recording of interviews to be an important and useful research tool and essential when the interviews are intended as the main source of data. All of the interviews for this research were recorded and in compliance with best practice and law the respondents were informed and their permission received. The recording of each interview was replayed, and where possible transcribed, prior to the next interview occurring to facilitate identification and development of emergent themes.
3.4 Analysis

As illustrated in figure 26, the interview transcripts were initially imported into a CAQDAS (Computer Aided Qualitative Data Analysis Software) application called QDA Miner Lite. The decision to use CAQDAS was based on the advantages it offered with many of the routine or mechanical tasks of qualitative research rather than with any actual analysis, for which there is no replacement for manual analysis and coding (Roberts and Wilson, 2002).

Once transcribed, the data was then verified by checking the transcription against the audio recording and loaded into CAQDAS. Repeated examination of interview transcripts enabled the allocation of categories or themes to sections of data via coding.

Fig. 26: Illustration of the data analysis process
CAQDAS allowed the construction of hierarchical coding scheme and facilitated coding retrieval that positively impacted the exploration and analysis of the data.

The coding categories were allowed to emerge inductively from the transcripts while the actual titles of the categories were formulated cognisant of the terms used in existent literature. The coding structure, however, was organised to reflect the theoretical context of the research, the three major constructs of the TOE model, technological, organisational, environmental were used to group the emergent determinant factors into their domains and codes were assigned to data that the researcher perceived to be a determinant factor.

While Saunders et al. (2009) warn about the prescription of theory to the analysis approach negatively influencing the findings, this researcher feels that the broad nature of the major constructs of the TOE model mean the risk to the integrity of analysis is minimal. As coding progressed, new themes emerged and data units were often reclassified into a series of categories and related subcategories using the software’s hierarchical tree structure.

3.5 Data integrity

In the context of qualitative research, validity is defined as the extent to which the data collected are plausible, credible, and trustworthy, and defensible when challenged (Venkatesh et al., 2013). Venkatesh et al. (2013) posited three broad areas where validity can affect qualitative research:

- Descriptive validity: the accuracy of what is reported
- Interpretive validity: the accuracy how that is interpreted
- Theoretical validity: the accuracy and coherence of the theoretical explanation
Carcary (2009) identifies the “scientific holy trinity” of validity, reliability and generalisability as being appropriate for use in assessing qualitative research and Saunders et al. (2009) identify forms of bias as also impacting the integrity of the findings derived from qualitative interviews.

Reliability is determined by whether other researchers would reveal similar information using similar methods (Carcary, 2009). By the very nature of interviewing experts at a particular moment in a technology’s development the extent to which similar methods would gather similar views and findings is limited. Different experts may have different perspectives and views and as technology evolves and the context changes so may the perceptions of that technology. However, efforts were made to ensure reliability by ensuring a rigorous research design and coherent philosophical basis that supported a structured approach to interview preparation and delivery.

Forms of bias from either the interviewer or interviewee may taint the integrity of the results and efforts were taken to limit that possibility. To mitigate against researcher bias, questions and introduction were written in advance and edited to limit the chances of bias and interviews were recorded with an audio recording device to minimise risk to descriptive validity. With a view to minimising interviewee bias the researcher ensured that the interviews were carried out in a professional manner conducive to interviewees feeling comfortable expressing their actual opinions free of pressure.

The ability to achieve generalisable findings with qualitative research is limited by the typically small sample sizes (Saunders et al., 2009). This limitation has been explicitly acknowledged in the construction of this exploratory, inductive, qualitative research and should not impact the objectives of the research. Saunders et al. (2009) posit that the researcher’s ability to contextualise their findings in existent theoretical frameworks will go some way to enhancing
generalisability and this research, through secondary data gathering, has endeavoured to achieve this goal.

The theoretical validity of this research is founded upon the quality of the secondary research, however a dilemma faced throughout the coding and analysis work was managing the subjective nature inherent in the qualitative research process. The researcher’s response was to rely upon the consistency of responses from respondents and employ triangulation to ensure multi perspective validation (Trauth, 1997). In addition, the researcher made every effort to constantly question themselves as a potential polluting source of data, maintaining a heightened sensitivity to their own assumptions and maintaining a “posture of being self-conscious,” (Trauth, 1997).

### 3.6 Ethics

Ethical concerns emerge throughout the research lifespan, from access considerations through to collection, analysis and reporting of data and so it is critical that ethical concerns are addressed at the planning stage and continue to be considered throughout (Saunders et al., 2009).

This research has been designed to ensure it is both methodologically sound and morally defensible to all those who are involved and this researcher takes the deontological view that the ends served by the research can never justify the use of research which is unethical. Although the topic being researched is not particularly sensitive in terms of the amount of personal or controversial data being collected, non-maleficence still forms the cornerstone of the approach to any ethical issues that arise.

At the access negotiation stage, all interview arrangements were conducted electronically to establish informed consent and a coherent audit trail and consent was attained for any tape
recording. As the respondents were all senior or very senior managers there was minimal opportunity or risk of them being coerced in any manner either during negotiation or during the interview proper. The researcher was open and explicit about the purpose of the research and its intended use as trust is a critical element in the successful interviewing relationship. Requests for anonymity were not expected given the topic of the research but the issue was broached and had it been of concern, the wishes of participants would be absolutely respected.

In accordance with the deontological view, analysis was completed in a manner of absolute objectivity at all times with the rights and well-being of participants being respected and honoured at all times.
4 Data Analysis/Findings

The purpose of this research is to identify and understand the TOE factors that are affecting the adoption of CC in Irish hospitals. This chapter presents the analysis of the content generated by the 5 participant interviews. As discussed in Chapter 3, the interviews were transcribed and parsed with the aid of a CAQDAS tool to identify the emergent themes.

4.1 Data Security

A common theme running strongly through all of the interviews were the issues surrounding the securing of critical systems and the handling of sensitive patient data. All of the respondents identified this issue as being the most critical for them. A broad definition of data security, synthesised from the literature review, was accepted to include physical security in accessing machines, identity management for accessing data and resources, application security and data confidentiality and privacy, as well as data protection and confidentiality. It would be possible to take a more granular approach to the security issue, creating subsets of data security and data privacy for example, but for the objectives and the context of this research the broad perspective was the most suitable.

The data security concern was identified by all respondents as being of critical importance when assessing the merits of CC for their hospitals:

“The overriding concerns would be data integrity and security”
“The biggest challenge to all of this is of course data security – privacy and patient information”

“The whole knowledge that it's not in your data centre, it's out there in the cloud – you have lost control of the storage of it, you are trusting a 3rd Party. You have SLAs in place but at the end of the day when you are selling this to senior management, this is their real concern. It's a huge thing in hospitals. This is the biggest thing to overcome and the providers need to give assurances that they are secure and that the end-to-end linkages are secure and can’t be hacked. There needs to be a solid SLA with the provider in case it all goes pear shaped – what is the back-up plan? What is covered? What is the redress?”

However, upon deeper exploration a more nuanced position in terms of these concerns emerged, with respondents suggesting that the concerns had been exaggerated beyond what they should be:

“Sometimes people get a lot stronger about the security than maybe it has to be ... and I can understand why and we need to have secure solutions”

A consensus emerged that although the security and privacy issues had to be addressed, they did not pose a barrier to adoption:
“It’s a concern but it's not an impediment”

“For me security would not always be the number one priority”

A number of respondents went even further, observing that cloud was a solution to security concerns rather than a concern itself:

“We can probably protect a commercial cloud product, whether that's public or private, probably more easily than we can an internal one”

“Positive ones – is the data more secure in the cloud? With all the technology that is there as opposed to local, we can feel more comfortable with the fact that, as a large organisation such as Microsoft is guaranteeing the integrity of the data. You would feel more secure.”

Finally, the impact of over compensating for security concerns was raised and the negative impact it had on functionality and service delivery:
“Our doctors, for example, put massive resistance to it, saying “look you are putting more solutions than I need to get in to my bank accounts – what do you want me to use that for?” We obviously need to be ticking every box but also sometimes there is an element where we need to be reasonable as to the level of security that needs to be there in what we are trying to implement. I think there are a lot of guidelines out there in terms of security and data protection, and you can easily see if the solution ticks the boxes or not, without trying to reinvent security solutions either”

4.2 Cost

The financial considerations when assessing a potential CC implementation were agreed to be of significant importance and largely the perception was that CC offered positive benefits in this regard:

“If you can prove to them that you are spending money on a project that is ultimately going to save them money over x number of years, then you will get their ears pricked up”

“Cost would be the big factor”

“What does it deliver to the bottom line?”
“In my experience in private hospitals, it comes down to the bang for the buck”

“As I said earlier, it’s in the top right of the Gartner Quadrant. Twenty or thirty years ago, to get system in that quadrant, it’s like the Rolls Royce of IT. For me to get a Rolls Royce IT product 20/30 years ago, cost would almost certainly have been a major impediment. I would have had to scale back on my criteria and standards to get it.”

“The big selling point for the hospitals is that you can have that lower percentage spend on IT so you can spend more revenue on your patients”

However, there were dissenting views as to the financial benefits accrued from CC:

“It has not been attractive to us from a financial point of view, meaning that every time we looked at cloud versus no cloud, the cloud solution was significantly more expensive”

“Cloud is another word for “let’s rip the customer off”. It’s extraordinarily expensive and if you want any sort of resilience or redundancy it means more
cost... The more critical systems that you put into the cloud the more important it is that you have instant reliable fully redundant access to the cloud. That is extremely expensive.”

But the prevalent opinion was strongly positive towards the OpEx (operational expenditure) budgetary model of CC rather than the CapEx (capital expenditure) approach to traditional IS projects:

“The lack of a CapEx is a big, big plus and the sharing of the overall infrastructure cost”

“It would take a lot to get CapEx approval for that. However, it’s easier to say there is a service I can get, and they will look after all that for me – they will already have another storage solution for me, with very little doubt.”

“It just makes it easier – it is more a model which sits in with your year on year annual budgeting. It’s easier for your top guys to understand – they are often coming from a financial / accounting background so it sits in better with their psyche about how to run a business. They see it as yearly plans – what are we spending next year, in 5 years, and so on. More of your costs are routed towards Op Ex and if you can bring them a model like that, it sits so much easier with
them and they can budget it every year and you can almost anticipate that the cost will be lower in 5 years' time because the competition will be higher etc. so they can almost factor that in to budget projections. It's a lot easier to get budget for it – it's quite challenging to get large lump sums of Cap Ex”

However, it is worth noting that this perspective was not universal and that one respondent’s organisation preferred the OpEx budgetary model:

“Our organisation would always prefer CapEx versus OpEx. So for example they would say, we want to put in a new solution, how much is it going to cost now? If they have the money in the bank and if they feel that it's something worth doing, then ok. They are much more reluctant to put in a solution which has a massive immediate impact on OpEx, so then it's something you are going to have to deal with for years and that is putting pressure on the business etc.”

4.3 Perceived Usefulness

The perceived usefulness category was defined to cover instances where respondents identified aspects of CC that would improve their task performance. This conceptualisation was derived from the Technology Acceptance Model (TAM) (Davis, 1989)

Respondents repeatedly identified the ability of CC to improve the ability of users to carry out their tasks as being critical to the adoption decision:
“When CC becomes an asset in relation to work flows and it’s as simple as that, for example”

“That's why for me, it will all depend on the functionality – does it make sense for our end user, does it simplify the technical element of the solution so that they really enjoy the benefit from it without having to really know all the complexity that goes behind it”

One respondent put it succinctly when saying that the functionality was more important than the technology:

“At the end of the day, the infrastructure which will support the solution is nearly second to the solution itself, which it should be. And for me, that's where cloud is”

This primacy of functionality was related back to traditional IT implementations and the implication on costs the added functionality might have:

“As I said earlier, it's in the top right of the Gartner Quadrant. Twenty or thirty years ago, to get a system in that quadrant, it's like the Rolls Royce of IT. For me
to get a Rolls Royce IT product 20/30 years ago, cost would almost certainly have been a major impediment. I would have had to scale back on my criteria and standards to get it.”

And also on the hospital’s competitive proposition:

“From a medical tech point of view and from making it easier for the consultants to do business in the hospital. They bring the patients to the hospitals and that's where we make the money and if we make the hospital easier to use for the consultants then they'll use us.

Within the broad umbrella of perceived usefulness three themes worthy of independent discussion were evident: Digital Transformation; Systems Agility and Patient Care.

4.3.1 Digital Transformation

The changes rapidly occurring in organisations’ business models, processes and structures, through the adoption of IS, is leading to a digital transformation (Hess et al., 2016) which is characterised by the DiSoLoMo trend (Kreutzer, 2014) which encapsulates the focus on Digital, Social, Local and Mobile facets of IS developments:
“As soon as you discuss mobiles, it straight away starts the conversation about CC because most organisations nowadays don't have a full mobile department (by mobile I mean people creating apps and being able to put those apps online) so that is something that is still very specialised”

“The internal infrastructure we have is not robust enough for purpose from a digital healthcare solution”

“The biggest driver is that everyone can access all of the data, all of time regardless of where they are.”

Consistent with the focus on patient care generally, there is a focus within the digital transformation that directly addresses the potential benefit to the patient:

“The need to make information available to patients... across the integrated care system and it's easy to do that if it's in a cloud solution”

“What cloud does is it sets us up for the future when a member of the public who isn't ill can have access to information which will keep them out of healthcare. So there is a big piece in that space”
Also apparent was the impact digital transformation could have on the medical staff, and thus indirectly on the patients, in improving their capabilities:

“What it means for us is that we want to make it as easy as possible for the GP to send patient details to the hospital”

“More and more I see cloud being relevant to Irish hospitals, particularly in the private sector, in the public as well, because of how doctors in particular and consultants work and like to work. We have about 300 consultants, they’re our customers and a lot of them don’t exclusively work for us. They would have a practice in another hospital and to be able to simply and easily access their patient data is what we’re trying to work towards. Whether it's on site or in the cloud but it’s to try and facilitate more mobile patient care”

4.3.2 Systems Agility

A theme that was evident in all of the interviews was the ability of CC to facilitate greater systems agility whereby organisations benefit from having a responsive IT infrastructure that can be changed to meet changing business needs:
“Absolutely, the speed that they want to be able to move at is driving adoption”

But also the role of cloud as a driver of innovation was cited as a determinant of adoption:

“Cloud allows us to be more innovative and to move more quickly around how we handle data and what we do with data so it's a huge part of where we are going”

“I think one of the big parts around cloud is that it does make it easier to catch up, because you are not trying to maintain your own data centre, you are not trying to move so quickly against a huge flow of content – there is a big part around that, it makes it easier for us to do what we need to do”

“Cloud allows you to be more agile. The business, whatever it may be, expects a speed of reaction from IT that if you are trying to do all of the stuff yourself, you can't always ...and therefore having a cloud vendor and cloud technology means you can react more quickly”

4.3.3 Patient Care
A recurrent theme that, given the context of the research and its objectives, warrants a sub-domain of its own is the focus of respondents on patient care when considering the perceived usefulness of CC:

“I'm always looking at what it can achieve for the patient – how can it make the patient experience better”

“What does this deliver to the patient?”

“As long as it achieves the business need and patient needs”

4.4 Available Resources

Respondents identified the impact cloud could have on the organisations’ IT resources, with some citing the releasing of existing resources as a positive:

“In practical terms, right now we have our in-house data storage and we have DBAs employed to manage it, and we archive into a data centre. It is quite complex to manage that archive and ensuring it’s replicated. There is the datacentre cost and complexity, there is the building of it and the expansion of it from time to time, all of that complexity, whereas once we get the StorSimple
solution up and running in partnership with a vendor, and we start archiving our data, then that further expansion complexity, we don't have to worry about that so much”

“The cloud is about lightening the load on our teams”

“I think that's fair to say – that freeing up our resources is an attraction with the cloud, that would be a positive.”

And other respondents identified the ability to leverage capabilities not available in-house:

“Obviously, for us that is a very difficult and technical solution to put in ourselves, whereas it made sense to put it in the cloud straight away because it was much easier in the cloud”

“Our own in-house capabilities have to be considered, questions like if we decide to retain the staff, do we need to hire more DBAs, do our DBAs have the skills required, we need to get the staff in to manage it, to archive it”
4.5 Organisation Size

A number of respondents cited the organisation’s size as a relevant factor in the adoption decision:

“We are a 1 site hospital; therefore, you cannot apply the same economy of scale to cloud that you can in 5 or 6 sites. Obviously, the more sites you have using the same solution, the more worthwhile cloud is”

“If we had 2 or 3 sites with the exact same system, we would definitely straight away be hosting it in the cloud. There would really be not much thinking in doing that. It would be a lot less expensive than buying hardware for three sites and hosting it and having 3 different teams managing it”

“Unless you are that huge organisation that can do more than we can at the moment, there is that side to it as well”

“You have to look at the whole thing about the size of your organisation. It makes more sense for larger organisations”
4.6 Regulatory & Legal Context

All organisations are sensitive to environmental influences and in the case of the public hospitals in the context of this research the dominant external influence is the HSE:

“There is a brand new directive which came from the HSE stating that any solution being looked at should be cloud first. That’ll have an impact of course”

“What the cloud first policy means is that from now on, if a hospital or organisation in health is deploying a new system, they must assume it’s on a cloud solution first and persuade the organisation otherwise if it’s not going to be cloud. It’s an attempt to realise that the internal infrastructure we have is not robust enough for purpose from a digital healthcare solution”

There were also governance considerations that were unique to private hospitals:

“A medical system in a private hospital has to go through FDA approval in the states”

“There are no regulatory issues but the private hospitals all go through an external certification for health insurance companies every three years”
“It's a private organisation so we are freer to make decisions and to move, to overcome concerns maybe a little bit easier than the public sector”

Finally, issues pertaining to both public and private sectors emanating from European Union regulations governing the storing of personal data were articulated:

“Now, we do need to bear in mind EU legislation in terms of where the data is hosted, and where in turn Microsoft back it up, so if I come back to our implementation, our data would be stored in London and backed up into Amsterdam – it can't go outside the EU”

“Yes, we need to be compliant. For instance, if someone said to us we can store all your data and it will only cost $10 per month per terabyte but you have to have it in New York, we would have problems straight away.”

“Some vendors will offer you the opportunity to host it locally as well as going to the cloud. But I think very few people are not hosting it on the cloud. And by virtue of the fact that it's an IT helpdesk, as opposed to a clinical system, there were no restrictions on us from a patient confidentiality or business confidentiality point of view, we had no issues there”
4.7 Vendor Support

A perspective common to all respondents was their belief that adoption of CC could provide to them considerable benefits in the form of advanced vendor capabilities and general support:

“It's a relatively straightforward economies of scale question really...there are thousands and thousands of people who work for AWS or Microsoft or whoever, and therefore they can quite clearly maintain higher capabilities than the people in house”

“In practical terms, right now we have our in-house data storage and we have DBAs employed to manage it, and we archive into a data centre. It is quite complex to manage that archive and ensuring it's replicated. There is the datacentre cost and complexity, there is the building of it and the expansion of it from time to time, all of that complexity, whereas once we get the StorSimple solution up and running in partnership with a vendor, and we start archiving our data, then that further expansion complexity, we don't have to worry about that so much”

This outsourcing of capability and risk was another factor in the adoption of CC:
“It's crucial really, because the alternative is to hire in experts and expertise and you will have those on your payroll forever, whereas now to get this thing up and running we can work with partners and work and learn from the partners”

“Let's move into a place where the big multinationals can manage it and help us handle it more easily. It's not the public sector not doing its job, it's the multinationals doing what they do”

“What we end up with by moving to cloud is a new model which puts that problem in their place, to keep things up to date, rather than us doing it”
5 Discussion of Results

The following section will contextualise the findings of the primary research within the existent literature in order to purposively address the research objectives. Sources from the literature review and also non-reviewed sources will be used to expand on the themes identified in the findings delivering valuable analysis.

The objective of this study is to identify and explore the factors that affect the adoption of CC in Irish hospitals. This objective was to be furthered via the 3 research questions:

1. What technological factors affect CC adoption in Irish hospitals?
2. What organisational factors affect CC adoption in Irish hospitals?
3. What environmental factors affect CC adoption in Irish hospitals?

The following discussion of the findings will thus be framed using the TOE model. The three major constructs take a holistic perspective on the variables affecting adoption. Tornatzky and Fleischer (1990) proposed that the technological, organisational and environmental contexts influence the process by which innovations are adopted. This study contributes a set of determinants of cloud adoption, which serves as a foundation for the future research and advancement of the theories in the information systems field.

5.1 Technological

The technological context of the TOE framework is comprised of the characteristics of a technology that influence an organisation's adoption of innovations.
5.1.1 Data Security

The issues concerning data security are well documented, both in CC generally (Alkhater et al., 2014; Bannerman, 2010; Dutta et al., 2013) and in the hospital context in particular (Ben-Zion et al., 2014; Escobar-Rodríguez and Romero-Alonso, 2014; Griebel et al., 2015; Lian et al., 2014) and in effect a consensus exists among researchers that it is the primary issue affecting the diffusion of CC technology. The findings from this research are consistent with this consensus, with all respondents identifying it as the highest profile area of the technology when it comes to the adoption discussion.

However, it is in the detail and the nuance where the exploratory nature of this study can be realised. In the discussions about security, a second consensus emerged amongst respondents, that security considerations were often over-emphasised unnecessarily. Two of the respondents suggested that CC could be more secure than traditional IT and this is not a theme that is identifiable in the literature. Only Kuo (2011) raises this possibility that CC can improve security “because cloud providers…are able to devote huge resources to solving security issues that many customers cannot afford”, all other researchers appear to accept, unchallenged, that non-CC solutions pose less risk.

Without directly addressing the relative security claims of traditional vs CC, Elena and Johnson (2015) do raise the issue of the perceived versus objective risks of CC, positing that, irrespective of objective risks, heightened perceived risks operate as an objective adoption barrier. Iye et al. (2013) address this risk gap as an issue of trust for the public and customers and Kuo (2011) suggests that non-profit third party oversight and government regulation can help close the trust gap.
Identifying potential consequences of the security focus, one respondent suggested that overbearing security considerations could hamper functionality and usefulness. This perspective is an echo of a fear that was forcefully emphasised in Kotz et al. (2015) by a medical practitioner who feared “the day when your security requirement kills one of my patients”

Whilst it is to be hoped that that scenario remains only a fear, it does raise the question of balance between security concerns, be they perceived or objective, and functionality. In their study on EHR systems, Ben-Zion et al (2014) found that achieving the right balance between security and accessibility constituted a critical success factor and in their study on privacy issues for mHealth, Harvey & Harvey (2014) suggested that the financial burden of security also needs to be factored in when seeking the balance.

However, there is little doubt that certain characteristics of CC present new or unique security challenges that must be met. The distributed architecture of the cloud presents the probability that patient records are stored at and shared with multiple third-party providers where the data is vulnerable to loss, leakage or theft, unauthorised access and attacks at each of the multiple locations and while in transit. The shared tenancy model typical of CC raises additional risks should the data separation mechanisms fail allowing data leakage. It is the fact that some of the very CC characteristics that drive adoption: virtualisation, multi-tenancy, shared resource pooling, web deployment, and utility service are the root of the security concerns that could present the greatest challenge to getting the balance between security and functionality right.
5.1.2 Cost

Two aspects to the question of CC costs were dominant in the findings of this research, the first being transition to an OpEx budgetary model and the second being the potential economic advantage from leveraging the scalability and utility pricing characteristics of CC thus allowing organisations pay for only what they consume.

The transition to an OpEx model, facilitated by CC, allows organisations to avoid incurring the immediate and sizeable CapEx costs typical of traditional non-CC deployments where significant hardware, software and professional services expenditure must be incurred to deliver the solution. CC allows organisations to convert those upfront costs into deferred OpEx payments which organisations are already familiar with from dealing with utility and service providers. This facet of the cost discussion, although common to all industry sectors (Iye et al., 2013), resonates strongly for Irish hospitals where budgets are under constant and aggressive downward pressures.

Hasty et al (2012) in their study of comparative attitudes to CC between public and private sectors found that the public sector was less concerned with the economics of CC relative to the private sector. Their findings, that the public sector instead prioritised performance and reliability over cost, as opposed to the private sector where the economic aspects were fundamental to the adoption decision, may have been interesting in the context of this research. However, the respondent profile was so heavily skewed towards the private sector in this research that no meaningful analysis of this facet was possible.

One of the respondents, from a private hospital, did suggest that there were sectoral differences between public and private hospitals and that price sensitivity is more acute in the private sector
and is a major driver of CC adoption. The single public sector respondent in this research, did suggest that there was a CapEx tradition within the public sector hospitals that would need to evolve in order to for CC adoption to increase. The existence, and nature, of any sectoral differences between the public and private sectors presents future researchers with a potentially fruitful line of enquiry.

Acute price sensitivity resulted in a number of respondents, from both sides of the public-private divide, citing the presence, or perception, of hidden costs related to CC as being significant barriers to adoption. These hidden costs were cited in the literature, particularly by Dutta et al. (2013) who posited hidden costs as a critical risk in their risk ontology and found that over 56% of their respondents perceived there to be a high to medium probability and frequency of occurrence of hidden costs in current cloud practices. Costs related to such service add-ons as disaster recovery, application configuration, and data loss insurance may not be highlighted by vendors, and which of course may also be increased over time, are typically necessary for larger organisations. Elena & Johnson (2015) found that decision makers, although attracted by the economic convenience of CC could not be confident of the overall cost and their concern that hidden costs would affect the economic rationale behind CC was acting as a barrier to adoption.

Despite these hidden costs, one respondent succinctly illustrated CC ability to resolve the twin pressures of reducing costs while increasing capabilities “For me to get a Rolls Royce IT product 20/30 years ago, cost would almost certainly have been a major impediment. I would have had to scale back on my criteria and standards to get it.”

The CIO of the HSE, Richard Corbridge, speaking of the HSE cloud first policy concurred stating that “given the investment gap that the HSE IT function is tasked with working with, this
allows us to access innovative information systems that may not have been affordable without doing this.” (Cullen, 2016). While the fear of hidden costs can act as a barrier to adoption, the potential for CC to improve capabilities and enhance performance acts as a counterbalance to that fear.

5.1.3 Perceived Usefulness

Perceived usefulness (PU) is a construct from the TAM adoption theory and is defined “the degree to which a person believes that using a particular system would enhance his or her job performance” (Davis, 1989).

As discussed in the literature review, the TOE model is very flexible and researchers have repeatedly leveraged its adaptability to their advantage (Gangwar et al 2014). This flexibility results in the researcher making a number of subjective decisions both with regard to choosing factors, placing them within one of three general constructs and of course categorising the raw data within the constructs.

The majority of researchers have utilised the relative advantage (RA) construct of the DOI model (Alshamaila et al., 2013; Hess et al., 2016; Safari et al., 2015; Salah Hashim et al., 2015) including Stieninger and Nedbal, (2014) and Gangwar et al. (2015) who both considered PU to be one factor within relative advantage. Although PU is similar and closely related to the frequently used RA it has a narrower more coherent definition (Fichman and Carroll, 2000). For this, and the inclusion of other factors, such as cost, into RA this researcher believes RA to be
too general a construct and for the exploratory purposes of this research the narrower definition of PU is of more value.

Departing from the theoretical debates it can be seen from the findings that the decision makers within Irish hospitals consistently perceive CC to be an enabling technology capable of improving their capabilities. Under the broad umbrella of PU, three themes worthy of independent discussion were evident: Digital Transformation; Systems Agility and Patient Care.

5.1.3.1 Digital Transformation

According to (Escobar-Rodríguez and Romero-Alonso, 2014) the strategic role of IS in hospitals can be classified into three categories:

- Automation of previously manual processes.
- Information provision and dissemination
- Transformation of business models and processes

CC undoubtedly plays a role in all 3 categories but it is the potentially transformative impact that CC can deliver through its enablement of digital tools, characterised by DiSoLoMo functionality (Kreutzer, 2014), that respondents cited as impacting the adoption decision.

Agarwal et al. (2010) acknowledged CC as an enabling factor of the digital transformation of healthcare and a range of potentially transformative capabilities have been attributed to CC:

- Data sharing and integration (Ben-Zion et al., 2014; Calabrese and Cannataro, 2015; Elena and Johnson, 2015)
• Enabling mobility of data, access and personnel (Calabrese and Cannataro, 2015; Elena and Johnson, 2015; Harvey and Harvey, 2014)

• Increasing collaboration amongst medical teams (Ben-Zion et al., 2014; Calabrese and Cannataro, 2015; Elena and Johnson, 2015)

Ben-Zion et al. (2014) cite the potential of CC for building intimate relationships with patients and educating them about relevant medical issues. They conclude that utilising mobile end-user devices to improve accessibility is a CSF (Critical Success Factor) for EHR implementation, thus placing CC at the heart of a successful digital EHR. Bildosola et al. (2015) also place CC at the locus of three technologies: big data, social networking and mobile computing, thus underscoring CCs centrality to the evolving digital hospital.

It is notable that Lian’s et al (2014) study makes no mention of digital capabilities other than to note that CC has positively impacted the development of telemedicine and mobile healthcare. Their survey did not address the matter directly, possibly because digital capabilities were less prominent at the time and if even their respondents had been given the opportunity to raise it autonomously, any insights may have been subsumed within the prohibitively broad context of relative advantage.

5.1.3.2 Systems Agility

It is increasingly apparent that systems agility, having a responsive IT infrastructure that can respond quickly to changing business needs, has become a critical component of organisational agility (Goodhue et al., 2009). Organisations can become more agile and effective when they can scale their IT infrastructure, entering markets faster and meeting evolving customers’ digital
demands (Nkhoma et al., 2013). This capability of CC, to enable systems and organisational
agility has made CC more attractive for Irish hospitals and makes it a determinant factor in
adoption for them.

5.1.3.3 Patient Care

The recognition that technology can improve patient care while reducing costs has meant that
governments are willing to push the traditionally slow healthcare industry to a faster pace of
adoption (Calabrese and Cannataro, 2015) and in Ireland this impetus is being injected via the
HSE’s cloud first policy.

The CIO of the HSE, Richard Corbridge, stated that the cloud first policy means “that the
citizens of Ireland can benefit from high performance, secure computing for all of their health
data” and “allows us to access innovative information systems that may not have been affordable
without doing this” (Cullen 2016)

Ultimately, aligning the internal goals of patient care, organisational agility and digital
transformation with cost pressures and security concerns is imperative to determining CC
adoption in Irish hospitals.

5.2 Organisational

The organisation construct of TOE refers to largely descriptive measures, such as firm scope,
size, resources, that influence adoption.
5.2.1 Available Resources

The impact that CC adoption can have on both resource utilisation and resource availability, the themes identified by this research’s respondents, are reflective of the wider literature (Carcary et al. (2014b). Migration to the cloud can free up internal employee resources from regular maintenance tasks that add no value to the organisation, allowing them to focus on core competences that advance organisational objectives (Doherty et al., 2015). However, although many studies concur that resourcing considerations affect the adoption decision, not all share the perspective of the respondents in this study.

Lian et al (2014) find that the possession of adequate existing resources by the hospital IT department is critical to the adoption of CC, whereas the findings of this research suggest that Irish hospitals are focussed on the ability of CC to free up existing resources. The difference in perspective is likely a result of Lian’s et al (2014) focus on private cloud adoption, their respondents may have failed to consider that fully a managed service is an option for private cloud adoption and must therefore be built and managed in-house.

Like Lian et al. (2014), both Harfoushi et al (2016) and Sulaiman and Magaireah (2014) considered the impact that existing available resourcing had on the adoption decision. Both included resourcing under the category of IT readiness, in conjunction with other factors such as technical and financial resources. Neither study found that the adoption decision was significantly impacted by the level of existing available resources and Sulaiman and Magaireah (2014) found that CC was the best solution to overcome the lack of resources inside hospitals.

Therefore, the finding in this study in favour of CC’s ability to free up existing resources is not inconsistent with the findings of the other hospital studies. Indeed, in support of this research’s
findings, Harvey and Harvey (2014) cited the ability of CC to support the development of large-scale eHealth services while significantly reducing the need for health IT expertise and financial resources as a positive determinant.

In addition to freeing up existing resources respondents in this research also raised the ability of CC to provide access to heightened technical capabilities which would otherwise remain unavailable to them. The reviews by Griebel et al. (2015) Calabrese and Cannataro (2015) which identify and evaluate a range of CC healthcare products, provide considerable evidence supporting that perspective.

5.2.2 Organisation Size

A consensus exists, in support of the findings of this research, that organisation size does impact hospital’s adoption decision (Calabrese and Cannataro, 2015; Kuo, 2011). Considering organisations generally Borgamn et al. (2013) summarised the impact of size thus: “large firms usually have more slack resources available which can be used for pilots or larger scale investments…small and mid-sized firms will embrace CC more rapidly than large firms, which have invested in on-premises enterprise systems”.

Respondents in this research focussed on the impact that being multi or single site organisations would have on the adoption decision. Calabrese & Cannataro (2015) consider CC central to the resolution of issues of geographic scalability i.e. the ability to maintain performance, usefulness or usability regardless of expansion from concentration in a local area to a more distributed geographic pattern
5.3 Environmental

The environmental construct within the TOE model incorporates the competitive and operational context in which an organisation conducts its business and operations.

5.3.1 Regulatory & Legal Context

More so than many other industries, decisions within healthcare organisations about the implementation of enterprise systems are impacted by external stakeholders. The healthcare enterprise must comply with many privacy and security laws, regulations, rules, and industry standards intended to protect patient privacy. (Ben-Zion et al., 2014; Harvey and Harvey, 2014).

However, the regulatory environment that hospitals operate in does not necessarily have a negative impact on adoption, Borgman et al. (2013) posits that regulation can act either as a driver or a barrier to cloud adoption and Lee and Meuter (2010) found that government input can be a driver for HIT adoption.

In Borgman’s et al (2013) cross industry study on CC adoption, their hypothesis that organisations that are subject to stricter regulatory requirements are less likely to become adopters was not supported. They inferred from this that in well-regulated industries such as health care, decision makers are already familiar with data security and compliance requirements and so there is no fundamental change when considering the adoption of CC.

The respondents in this research took a pragmatic approach, accepting that the regulatory reality of their operational context had to be factored into their decision making process but that it did not necessarily represent an insurmountable barrier to CC adoption.
5.3.2 Vendor Support

Respondents in this research were unanimous in their belief that the role of vendors and their advanced capabilities acted as a driver of CC adoption for their hospitals. The in-depth knowledge and specialised areas of expertise being offered by CC vendors present hospitals with a remarkable opportunity to leverage advanced skills sets, which were previously impossible, difficult or expensive to access, and to utilise them in transforming their own capabilities (Agarwal et al., 2010).

The importance of vendor support is coherent with the findings of Harfoushi et al. (2016) who found that vendor scarcity also played an essential role given that the presence of sufficient, reputable, and competent vendors will encourage organisations to adopt cloud services and form a positive trust attitude towards cloud service transformation. Neither Lian et al (2014) nor Sulaiman and Magaireah (2014) test for the impact of vendor support or capabilities and, other than Lian’s et al (2014) observation that difficulties in transferring data or capabilities from one vendor to another (vendor lock-in) can negatively impact CC adoption, neither study addresses the role of vendors in the adoption decision. Although Dutta et al (2013) identified vendor lock-in as being the third highest perceived risk in their survey of IT experts in various industries, it’s absence from the findings of this research may indicate that the risks have been subsequently mitigated as the technology and competitive environment matures and, or that respondents considered the risks manageable.
The positive perception of the roll of vendors indicated by respondents in this research is supported by Iye et al (2013) who tested for perceived levels of vendor related risk, which they defined as fear of lock-in, business continuity and service availability risks, reputation fate sharing and unclear licensing issues, in the hospital sector. They found that the risks were not perceived as significant and theorised that as hospitals were part of the “organised sector”, decision makers in hospitals remain well informed and consider the risk manageable.
6 Conclusion

6.1 Introduction

This chapter summarises the findings, seeking to draw general conclusions and provide constructive analysis in terms of the issues and concepts relevant to the research questions and objectives. The limitations of the research will be presented in a frank and valuable assessment and opportunities for future research will be discussed.

CC is a computing and service model that has spread very rapidly in recent years. It’s emergence as a mainstream IS model has coincided with a growing healthcare requirement for continuous and systematic innovation in order to remain cost effective and efficient while simultaneously providing high-quality services. Despite the many benefits associated with CC for hospitals, research has consistently identified several management, technology, security, and legal issues that impact the diffusion of CC. The aim of this paper is to identify and evaluate the TOE factors that affect the adoption of CC in Irish hospitals.

6.2 Determinant Factors

The TOE theory of technology adoption was identified as the optimum theoretical framework within which to identify and evaluate the factors that affect the adoption of CC in Irish hospitals. Within that framework the research identified seven factors which significantly affected the adoption decision: data security, cost, perceived usefulness, resource availability, organisation size, regulatory & legal context and vendor support.

The major contribution of this research to the existing literature is the greater penetration and understanding of these complex factors that is delivered through the exploratory approach. The
consensus in the literature, that data security is the most critical factor in the adoption decision, is supported by this study but the respondents here were able to deliver the depth of insight that enables our understanding of the operational realities to grow. This research has shown that while there is consensus that data security is a critical factor, it is perceived as a potential driver of CC adoption in Irish hospitals, rather than a barrier, based on the economies of scale, in terms of security capabilities and resources, that the CC providers can leverage, a subtheme supported by findings from both Kuo (2011) and Elena & Johnson (2015).

This perception of vendors as important business partners in the delivery of hospitals’ IS services is further cultivated by the finding that vendor support is an important factor in the adoption decision. Supported by the findings of Harfoushi et al (2016), Irish hospitals appear ready to embrace an appropriate vendor as a valuable source of expertise, support and resources that they can access and utilise for minimal capital outlay and minimal fixed costs.

The influence of economics in the adoption decision is both profound and complex, while the majority expressed a positive relationship between the costs of CC and their attitude towards adoption there was widely held perception that hidden costs could undermine the perceived economic benefits. These findings, that non-transparent cost models could have significant negative impact on the propensity to adopt and critically on post adoption satisfaction levels, are consistent with the findings of Dutta et al. (2013) and Elena & Johnson (2015). The issue of hidden costs has implications for both vendors and hospitals; vendors looking to build valuable, lasting partnerships with hospitals should address costs in a more transparent manner while hospitals themselves must ensure they carry out detailed investigation, planning and preparation and implement technical solutions capable of mitigating the risk of hidden costs.
Perceived usefulness (PU), a construct from the TAM adoption theory, was utilised to categorise data where respondents exhibited the belief that using CC would enhance performance. This is quite a broad factor and thus a number of subthemes were utilised: digital transformation, systems agility and patient care, in order to better evaluate the implications of the PU factor for hospitals and vendors. It is apparent that the delivery of high quality patient care underpins the range of decisions being made by administrators, but also that the systems agility and digital capabilities that cloud can enable are perceived as being integral to the delivery of that care. The increasingly rapid digital transformation of healthcare capabilities relies on the characteristics of CC to leverage the greater agility necessary to fulfilling the digital potential inherent in the
technology-dependant provision of healthcare. The cloud’s ability to support that transformation while simultaneously allowing hospitals to maximise their available resources and enhance their available capabilities will be crucial to the delivery of the high quality patient care that is critical to Irish hospitals’ success.

The relevance of available resources to the adoption decision is multifaceted. Respondents cited the freeing-up of existing resources as well as the additional resources that CC makes available as being determinants of adoption. This insight, underexplored by the existing literature on adoption in hospitals, is somewhat contrary to the findings of Lian et al. (2013) who found that the availability of existing resources was critical to implementing a potential adoption. The focus of their study, on private cloud in larger hospitals, is a potential explanation for the disparity but the practical implication for stakeholders is the desire on the part of Irish hospitals for valuable partnerships with vendors beyond the mere provision of technical services.

The decision by the HSE to pursue a cloud first policy presents cloud vendors in Ireland with a significant opportunity to build partnerships with hospitals. The regulatory and legal context intrinsically affects the adoption decision, EU regulation on data privacy and data storage geo-restrictions impact the range of services available to Irish hospitals and the cloud first policy will now fundamentally alter the competitive forces of CC service delivery and adoption.

The findings of this research are critical to IS decision makers and stakeholders within the hospital context on both sides of the competitive equation. For hospital administrators the findings can help in developing plans for CC adoption. As the technology matures and becomes ever more mainstream it will be critical for decision makers to be capable and comfortable evaluating the CC offering. For service providers, this research can help them to clearly
understand the drivers and barriers to CC adoption in hospitals in Ireland and deliver a value proposition that is coherent with the multifaceted and complex factors which are impacting the adoption decision.

6.3 Research Limitations

There are limitations to this research which have impacted the breadth of findings the research was able to reveal and the depth of the findings that were made. Sample size may have restricted the depth of information available for subsequent analysis, however the researcher believes that the risk this limitation poses is mitigated by the population size and the consistency of results. As the results exhibited both an internal consistency, through the broad consensus within the findings, and also consistency with the findings of existent literature, it can be inferred that the small sample size has not significantly impacted the validity of the findings. In addition, though the sample size is small, it is also true that the population from which it was selected is small, therefore the sample size is adequate to support both the exploratory nature of the study and also its’ findings.

Secondly, the relative under-representation of the public hospital perspective is unfortunate. The reasons for this are manifold and could potentially constitute another research project but this researcher believes that this underrepresentation was mitigated by the strength and quality of the voice that was present.

6.4 Recommendations for Future Research

The role of technology in healthcare is increasingly important and as it becomes ever more critical to supporting and delivering high quality patient care, it should remain an area of great academic interest. There exists an opportunity for an investigation into a CC implementation in
an Irish hospital context, following the HSE cloud first policy announcement it is likely that there will be many cloud implementations in the near future, and a case study approach could yield great insights for the broader stakeholder community.

Lastly, the global body of research into the factors affecting CC in hospitals offers opportunities to carry out similar research in other locations. This can add value to the existing research and also improve the extent of knowledge in the research domain.
Bibliography


Appendices

A. Personal Reflection

On one of the first nights of lectures, nearly two years ago, the author stood in front of new classmates and spoke about themselves, why they were there and what they wanted to get from the course. The author made the decision that night to be honest with the class, and more importantly with themselves about what the author hoped to achieve over the course of the two years. It was hoped that by explicitly proclaiming those goals there would be less likelihood of a relapse to old ways.

A previous attempt at education, as an undergrad nearly 20 years ago had left a lasting sense of disappointment and some doubt over actual capabilities. While results then had been adequate, an honesty of effort had been lacking and subsequent doubts about an ability to commit fully had delayed this second attempt at education. Fear that failing, yet again, to honestly commit to the process would again waste a privileged opportunity.

Self-Appraisal

The author found two tools particularly beneficial in understanding who I was and how to get the best out of myself, Honey and Mumford’s Learning Styles and the Myers–Briggs Type Indicator helped me understand how to manage my learning style.
Fig. 28: Results of a Honey and Mumford’s Learning Styles test. Emtrain.eu (“Learning Styles Quiz,” 2016)

Broadly, as a Myers–Briggs ENTP and a Honey and Mumford’s Reflector the author was able to consider the general characteristics of these types and gauge their potential impact on the college process generally and this research process specifically. Typical traits such as the dislike of practical matters and finding it difficult to focus posed considerable risks and needed to be mitigated.

Fig. 29: Honey and Mumford’s Learning Styles mapped onto Kolb’s learning cycle (Rosewell, 2005)

Having developed a relatively successful method, over the two years, of producing successful work the author was prepared for some of the issues that would arise during this research. The author had learned that it was necessary to ensure that the work was commenced sufficiently
early and was broken into a series of intermediate deadlines culminating in a false deadline one week out from the actual deadline.

As well as such practical matters, the course of study had also contributed significantly to the author’s ability to comprehend the issues pertinent to this research. Having come from a technical background and never having studied business subjects the author was lacking in the business knowledge necessary to deliver this research and career progression. Without the new knowledge gained form the coursework, the author would not have been able to contextualise the technical aspects of CC in the business realities.

**Problem Solving**

Over the course of this research many problems were encountered. The most significant of these was the question of access to respondents. Throughout the process of this course and this research the author relied on the use of the reflective leaning cycle (Gibbs 1988) to assist in the processing of situations and their solutions. In hindsight there is no question that the process of seeking and arranging respondents was left too late. This greatly added to the pressure and the risks as it became difficult to envisage a contingency plan. The author took steps, by ensuring all communication conveyed a level of professionalism that might inspire a confidence in the researcher and the process, to maximise the chances of success in seeking and attaining respondents.
On reflection, the risk taken was too great and put in jeopardy the work of two years. Starting afresh, the author would be more mindful in the choice of topic, attempting to ensure a more accessible research population. However, the author still believes strongly in the research topic and the value of the research.

**Added Value**

Since beginning this course the author has become capable of engaging in the broader business aspects of the organisation. Having gained a business vocabulary and framework the author has realised a greater appreciation for commercial realities and in particular the role of technology.
and innovation in business. This upskilling was critical to the author’s ability to successfully interview senior managers for this research. Two years ago the author would have envisaged this research to be about CC but, with a new business perspective, it was understood that this research was as much about business objectives, service delivery, and patient care as it was about CC.

**Continuing the Process**

As an ENTP with a Reflector style of learning one of my significant challenges prior to, and during, this course was to produce reports and documentation professionally. It remains a difficult process: the author has a strong preference for research over productivity, and in an effort to cement the improvements, the author has commenced the conversion of this document into a 2000-word report for publication on LinkedIn and Twitter. The author has also been seeking further topics for publishing on social media and is currently considering researching the role of SDN (Software Defined Networking) in healthcare.

Finally, the author now needs to restart the career development process and look for opportunities to better leverage and challenge the newly attained capabilities and also develop new skills and knowledge.

**Conclusion**

Reflecting now on that opening night, on the goals, objectives and fears there is a sense of relief that it was the honesty rather than the disappointment that survived the journey. Having reached
the final days of the journey with the goals set that night still attainable, it is now apparent that, irrespective of whether those goals are met, what is important is that this time the author tried and that this time the author was honest to the opportunity.
B. Request for interview

Dear NAME,

I am completing a part-time MBA and am studying the factors affecting cloud computing adoption in Irish hospitals for my dissertation for which I am seeking participants for a 30-minute interview.

Using LinkedIn, I identified you as someone who can bring valuable insights to the research through your current role at ORGANISATION NAME and I hope you would agree to a 30-minute recorded interview. I am happy to come to meet with you or to interview by Skype at your convenience.

I believe that such an exploratory study can deliver valuable insights to the various stakeholders. In addition to exploring the current position and your own procurement and implementation experiences, the interview will look to cover the main drivers and barriers to adoption.

The topics covered in the interview will be informed by international research which has identified data security, data privacy, project complexity and systems compatibility as the most regularly cited barriers to adoption.

I include below a sample interview format:

- Does your organisation currently use any cloud based services?
- What stage are you at: Identification, Evaluation, Action, Follow-up?
- Key challenges, learnings and outcomes.
- The strategic decision to introduce cloud and its capabilities to achieve your goals
- Your views on primary drivers for adoption
- Your views on primary barriers to adoption
- AOB
I would like to assure you that if you wish to remain anonymous, that can be facilitated and completely respected. In addition, should you be interested in the results and findings I would be happy to share those with you.

Finally, I would like to thank you for your time and consideration thus far and I look forward to the opportunity to work with you. Should you be willing, my plan is to complete the interview during July of this year.

Kind Regards,

Brendan Dunne
C. Matrix of factors

In order to keep track of, and better understand the various factors used and found in the literature a matrix was built to enable quick search of the existent literature for particular factors. This also greatly aided in the identification of patterns.

<table>
<thead>
<tr>
<th>Tech</th>
<th>Org</th>
<th>Envi</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 31: An excerpt from the matrix of factors that affect cloud computing adoption
To aid in the creation of the literature review, a spreadsheet of the reviewed literature was created to facilitate a speedier search for literature relevant to a particular perspective or argument.

<table>
<thead>
<tr>
<th>Literature review matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>To aid in the creation of the literature review, a spreadsheet of the reviewed literature was created to facilitate a speedier search for literature relevant to a particular perspective or argument.</td>
</tr>
</tbody>
</table>

Fig. 32: A screenshot of a literature review spreadsheet
E. Interview Schedule

Introduction,

Good Morning NAME. Firstly, I would like to thank you for your time and very briefly introduce the research topic. I am researching what factors affect the adoption of cloud computing in Irish hospitals.

As such all deployment and service models of cloud as they pertain to Irish hospitals are relevant to the conversation.

I'll broadly divide the conversation into technical, organisational and environmental considerations but am happy to keep it organic and allow it to develop naturally. There will be a lot of cross over between topics anyway.

So, If I can start by asking you

What do you think are the drivers of cloud adoption in hospitals?

- You’ve mentioned xxx, are there any others?
- What is it about xxx that you think is so important?

What do you think are the main barriers to adoption in hospitals?

- You mentioned x and x, are there any other issues that come to mind?
- What is it about xxx that you think is so important?
Technical

How realistic is the premise that an organisation can fulfil a requirement faster and cheaper using cloud services?

What criteria are you looking at to determine whether a particular service is a good candidate for cloud outsourcing?

Privacy and Security: Are there unique considerations in terms of cloud and Irish hospitals?

- Has the delineation of security responsibility between vendors, service users, agents been sufficiently clarified?
- Is the private or hybrid deployment model a useful solution to security concerns?

Reliability is often paramount for Information Systems deployments, are there special considerations for CC?

Does the complexity of CC cause any problems?

Compatibility with existing systems is often an issue for IS implementations, does this present an issue for CC?

Are digital capabilities and developments part of the cloud adoption decision?

Organisational

CC requires a new set of skills, is this a consideration when assessing CC?
Does leadership and senior management support play a role in the adoption of CC in IH?

Has CC played any particular relevance in the strategic considerations?

In terms of the adoption decision what role is the alternative budgetary profile of CC playing?

Move to OpEx. Reduction in CapEx.

Are Irish Hospitals an homogenous group when it comes to CC or are there any distinct subgroups?

**Environmental**

How is the decision to adopt CC effected by external forces?

- Are the legal, regulatory and strategic spheres keeping pace with the technical developments?

In terms of both barriers and drivers, to what extent are individual hospitals in control of the rate of progress?

Do competitive pressures play a role in adoption in Ireland?
F. Dissertation diary

The author made constant use of a study and research diary throughout the duration of this course. By the beginning of this research process a diary methodology had been arrived at that allowed the author to document and reflect on the learning process. Saunders – can help in the qualitative research process. As well as the assistance it can provide as and a tool helpful for reflection on the direction of research and idea development (Saunders 2009) the diary served this author most usefully as an aide-mémoire. As somewhat of a disorganised learner this author discovered it was essential to keep track of what had been done and what yet needed to be done.

An electronic aide was the most suitable for this author and an application called Trello was selected. A cloud based tool, Trello could provide the anytime, anywhere access that was necessary to keep track of the thoughts and insights that could occur at any time.

A screenshot of Trello is provided below but it is merely a snapshot in time of what was as dynamic platform where thoughts and tasks migrated from column to column, were assigned due dates and attachments, colour coded and sorted, some of them lasting the full duration of the research process.
Fig. 33: Screenshot of the Trello research diary